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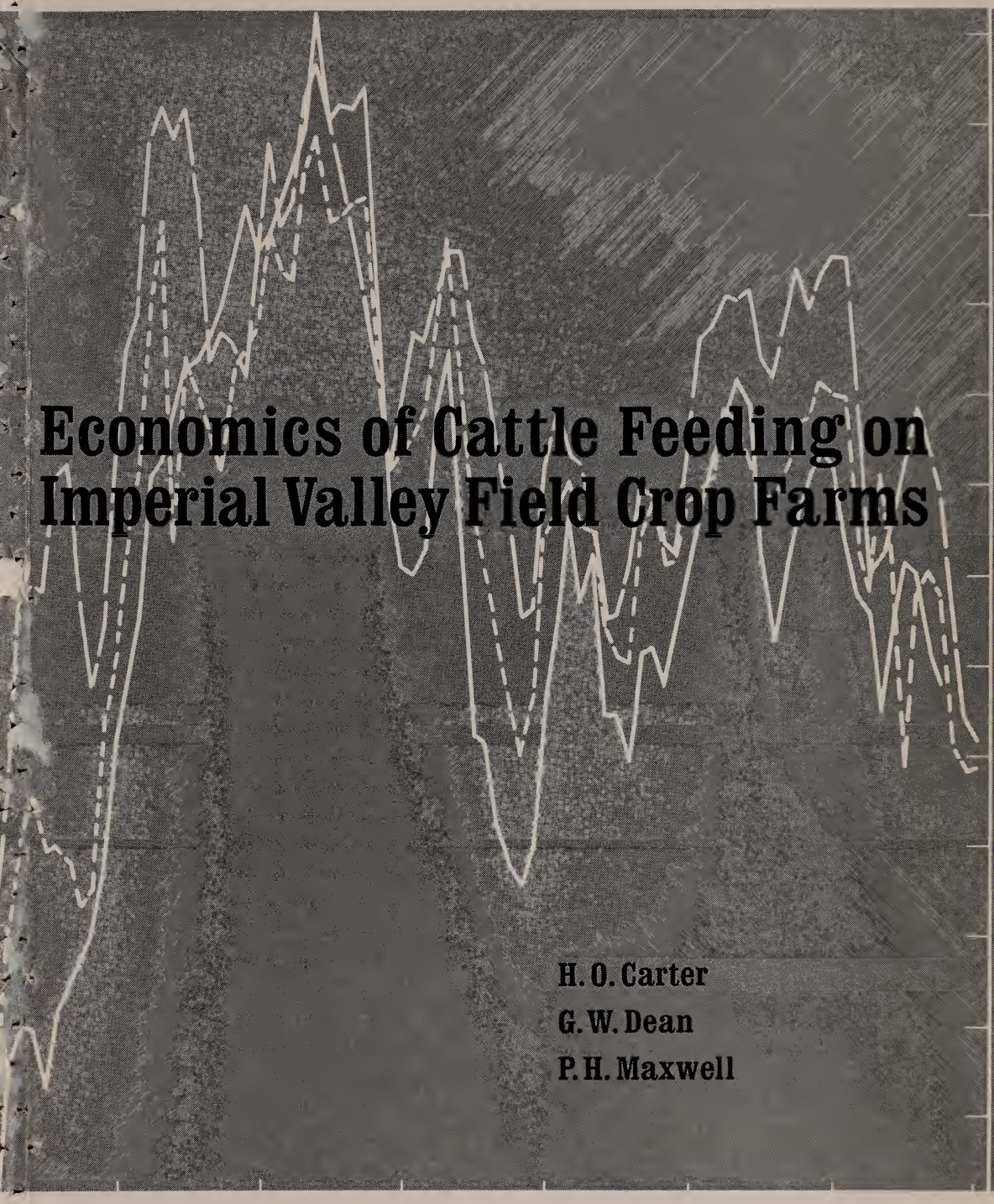

Economics of Cattle Feeding on Imperial Valley Field Crop Farms

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ECONOMICS OF CATTLE FEEDING ON IMPERIAL VALLEY FIELD CROP FARMS[1]

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INTRODUCTION

A recent cost-size study in the Imperial Valley indicated substantial cost reductions per acre for field crop farms as they increased in size up to 2,000 acres (Carter and Dean, 1962).[2] Some farm operators maintain, however, that expansion in acreage of smaller ranches is not always feasible because of the limited availability of good farmland at prices commensurate with present agricultural earnings. Additionally, farmers with fixed allotments of cotton or contracts on sugar beets, or both, are often limited in their ability to further intensify cropping programs in order to overcome size disadvantages. As a result, some operators have considered cattle feeding as a supplemental or alternative enterprise to their present cash cropping system. Two advantages often cited for integrating a farm feedlot or a pasture feeding operation, or both, with a cropping program are: (1) the volume of business and profit for the total farm should increase as a result of providing an internal "market" for grain and forage crops, and (2) certain fixed costs may be spread over a larger volume of total farm output.

On the other hand, a feedlot represents a substantial investment in facilities and machinery, even when organized on a limited scale (King, 1962). Also, the addition of a cattle-feeding enterprise requires a new set of management decisions and different managerial capabilities. Many managers may lack these capabilities or may prefer not to take the added risk of cattle feeding. However, more exact information on the economic aspects of crop-livestock operations in the Imperial Valley area would be helpful, not only to ranchers contemplating such reorganizations, but also to the bankers and businessmen who may be in a position to assist farmers in making adjustments.

OBJECTIVES OF THE STUDY

The objective of this report is to evaluate alternative crop and livestock programs which are economically feasible for small-scale farms operating under present conditions in the Imperial Valley. The results also should be generally applicable to contiguous desert agricultural areas.

Consistent with the over-all objective, major questions to be answered are:

(1) What are the most profitable cropping systems and the associated investment, costs, and returns for an efficient small-scale (480-acre) crop farm without livestock?

(2) What are the income incentives, investment requirements, and organizational changes associated with integrating alternative pasture and feedlot programs with a small-scale (480-acre) crop farm?

(3) How sensitive is net income produced by the farm to such factors as the level of cattle prices, price margins, and feed efficiency under different crop-livestock organizations?

METHOD OF ANALYSIS

Budgeting and linear programming are used in the empirical section of this report to evaluate the profitability of alternative crop-livestock programs imposed on the resources of a 480-acre crop farm. Linear programming is a mathematical technique for helping managers select the most profitable combination of crop and livestock enterprises consistent with specified assumptions of yield, prices, government acreage controls, and other resource limitations (Heady and Candler, 1958). The most profitable plans referred to in this study pertain to a specified set of farming conditions representing those typically found in Imperial Valley, California. Any particular farm situation will usually differ somewhat from the assumed conditions of

[2] See "Literature Cited" for publications referred to in text by author and date.

tenure arrangements, capital availability, etc.; therefore, the plans and incomes shown should be considered only as guides for managers.

Personal interviews with farm operators from 37 cash crop farms and 20 crop-livestock farms during the summer of 1960 provided much of the basic data for the analysis (Carter and Dean, 1962). In addition, a follow-up survey of 25 crop-livestock farmers was made in the spring of 1962 to obtain more detailed and current information about rations fed, feed mill investments, and labor requirements. These data were supplemented with engineering cost data and published and unpublished reports from personnel in the California Experiment Station and the Agricultural Extension Service.

PROCEDURE

The 480-acre size of crop farm with which this study deals is not intended to be an average or a recommended size for the Imperial Valley; rather, it is selected to depict an operation which, although too small to realize all of the possible cost economies in this type of agriculture, is still in a sufficiently sound economic position to warrant consideration by bankers and farm suppliers for assistance in any feasible reorganization plan.

Two main types of cattle feeding programs are analyzed: (1) heavy feeder production on pasture or greenchop feed, and (2) cattle finished in the feedlot. Feeding programs are compared with feedlot capacity fixed at three levels: 1,200 head, 2,400 head, and 3,600 head. Two feeding periods (150 days each) are considered feasible in 1 year. Alternative rations and sources of feed are also considered as an integral part of the analysis. Additional details on resources available and alternative crop and livestock programs are discussed in the following sections.

As cattle prices, margins, and feeding efficiency estimates are subject to variations from farm to farm and between years, a supplementary analysis provides information on how income varies in the most profitable plans with changes in above components. This should allow farmers to view results in a context more closely related to their own expectations and conditions.

PRODUCTION ALTERNATIVES

Crops

Imperial Valley soils are adapted to a wide range of field and vegetable crops. However, with the exception of leasing out land for lettuce, we restrict the alternatives to field crops, as this type of cropping system predominates on the Imperial crop-livestock farms. Table 1 gives the price and yield assumptions, while table 2 summarizes costs and returns for the three categories of crops considered: cash crops, cattle-feeding crops, and cash or cattle-feeding crops. The cash crops produce a return only through sale of the crop (cotton, flax, sugar beets, and leased lettuce). Sugar beet tops may be pastured or leased to other feeders for pasture, whichever is more profitable.

The cattle-feeding crops are used only on the ranch and for this study are not grown for direct sale. Therefore, these crops (grain and Sudan grass, pasture and silage) show only costs here (negative net return) and contribute to profits only when fed to livestock. Total variable costs for the pasture crops include only direct costs associated with growing the crop (for example, fertilizer, gas, oil, irrigation costs, labor, etc.). Fixed costs for machinery are discussed separately. Also, costs incurred from pasturing cattle—fences, watering facilities, etc.—are listed in cattle-feeding costs and discussed in a later section.

The remaining crops, consisting of alfalfa hay or greenchop, milo and barley, may be either sold or fed; linear programming determines the use which will add the most to the net income of the farm within the assumptions specified. More-

Table 1

PRICE AND YIELD ASSUMPTIONS FOR SELECTED IMPERIAL VALLEY CROPS

Crop	Unit	Yield per acre	Price (in dollars)*
Alfalfa hay	Tons	6.00‖	26.00
Green alfalfa			
Fall—150 days	Pounds TDN**	2,650.00	19.85
Spring—150 days	Pounds TDN	5,950.00	.....
Barley (early)	Tons	2.00	45.00
Barley (late)	Tons	1.50	45.00
Sugar beets†			
Beets	Tons	22.00‖	14.39
Tops	Pounds TDN	2,500.00	0.00256
Cotton	Bales	2.75‖	158.40
Flax			
Fiber	Bushels	45.00‖	2.90
Straw	Tons	0.50	13.50
Barley straw	Tons	0.33‖	13.50
Milo (early)	Tons	2.00	46.00
Milo (late)	Tons	1.50	46.00
Sudan grass‡	Pounds TDN	4,800.00	.....
Barley pasture§	Pounds TDN	2,500.00	.....
Oat pasture‡	Pounds TDN	5,000.00	.....
Sorghum silage (late)¶	Tons	18.00	.....
Sorghum silage (early—1 cut)	Tons	22.00	.....
Sorghum silage (early—2 cuts)	Tons	35.00	.....
Lettuce lease	Acre	.....	65.00

* Prices based on judgment and past prices received by Imperial Valley farmers.
† 16.2 percent sugar content.
‡ Over 90 day period.
§ Over 60 day period.
¶ 70 percent moisture content.
‖ Estimates: California Agricultural Extension Service (1960).
** Total digestible nutrients.

over, the choice may be a combination of selling part of the crop directly and feeding the remaining part. For example, alfalfa hay may be baled, roadsided, and sold during the summer, but it can be pastured from October through February. Alfalfa may be baled and fed to cattle on the ranch; it may be pastured all year or green-chopped all year, and so forth. Again, the negative sign on the net return denotes only the direct costs and indicates that the profit is realized when fed to livestock.

Climatic conditions in Imperial Valley allow year-round crop production and hence an almost unlimited combination of cropping and double-cropping systems. While planting and harvest months may vary somewhat from year to year, depending on particular soil and weather conditions, it is necessary for planning purposes to consider a fairly typical time schedule of land use for each of the crops considered in the selection of optimum cropping programs. Table 3, which shows the typical land usage by month for the individual crops included in this study, suggests the complexity of the problem of choosing high-profit combinations of crops which are within the resource limitations of the farm and yet mesh into smooth year-round operation. Tables 2 and 3 show that the same crop can be grown in different time periods, but sometimes with different yields, prices and net returns. In addition to flexibility in timing of the cash crops such as barley, milo and lettuce, the alternative pasture and silage crops also permit year-round feeding of heavy feeders if this proves more profitable than other alternatives.

Crops Rotations and Allotments

In selecting the most profitable cropping program for this study, certain acreage restrictions were specified in accordance with conditions existing on Imperial Valley farms of the general size considered in the analysis. Cotton and sugar beets were each limited to 72 acres per farm, which appeared as the modal acreage for

TABLE 2

SUMMARY OF VARIABLE COSTS AND RETURNS PER ACRE FOR CROP PRODUCTION ALTERNATIVES, 480-ACRE FARM IMPERIAL VALLEY*

Alternatives	Labor†	Machinery	Materials‡	Total variable costs	Gross returns§	Net returns¶
	dollars per acre					
Cash crops						
Cotton	21.28	11.72	256.90	288.90	474.90‖	185.00
Flax	4.96	5.01	56.25	66.22	136.50**	70.28
Sugar beets—tops rented out	18.96	10.86	151.18	181.00	322.98	141.98
Sugar beets—tops pastured	18.96	10.86	151.18	181.00	316.58	135.58
Lettuce lease	0	0	0	0	65.00	65.00
Cattle feeding crops						
Barley pasture	5.56	5.04	28.80	39.40	0	— 39.40
Oat pasture	5.56	5.04	28.80	39.40	0	— 39.40
Sudan grass pasture	5.85	5.65	33.50	45.14	0	— 45.00
Sorghum silage						
Early—1 cut	3.76	4.08	52.96	60.80	0	— 60.80
Early—2 cuttings	7.52	8.16	62.58	78.26	0	— 78.26
Late	3.76	4.08	47.59	55.43	0	— 55.43
Cash or cattle feed crops						
Alfalfa††						
Hay—sell—fall pasture feed	19.47	17.21	31.29	67.97	156.00	88.03
Hay—feed—fall pasture feed	19.47	17.21	31.29	67.97	0	— 67.97
Hay—sell—fall pasture rent out	19.47	17.21	31.29	67.97	175.85	107.88
Hay—feed—fall pasture rent out	19.47	17.21	31.29	67.97	19.85	— 48.12
Greenchop—pasture‡‡	6.19	3.86	31.29	41.34	0	— 41.34
Greenchop—pasture—rent out fall pasture‡‡	6.19	3.86	31.29	41.34	19.85	— 21.49
Barley (early)—feed	4.72	5.04	32.95	42.71	0	— 42.71
Barley (early)—sell	4.72	5.04	32.95	42.71	90.00	47.29
Barley (late)—feed	4.72	5.04	29.95	39.71	0	— 39.71
Barley (late)—sell	4.72	5.04	29.95	39.71	67.50	27.79
Milo (early)—feed	3.76	4.08	34.65	42.49	0	— 42.49
Milo (early)—sell	3.76	4.08	34.65	42.49	92.00	49.51
Milo (late)—feed	3.76	4.08	31.65	39.49	0	— 39.49
Milo (late)—sell	3 76	4.08	31.65	39.49	69.00	29.51

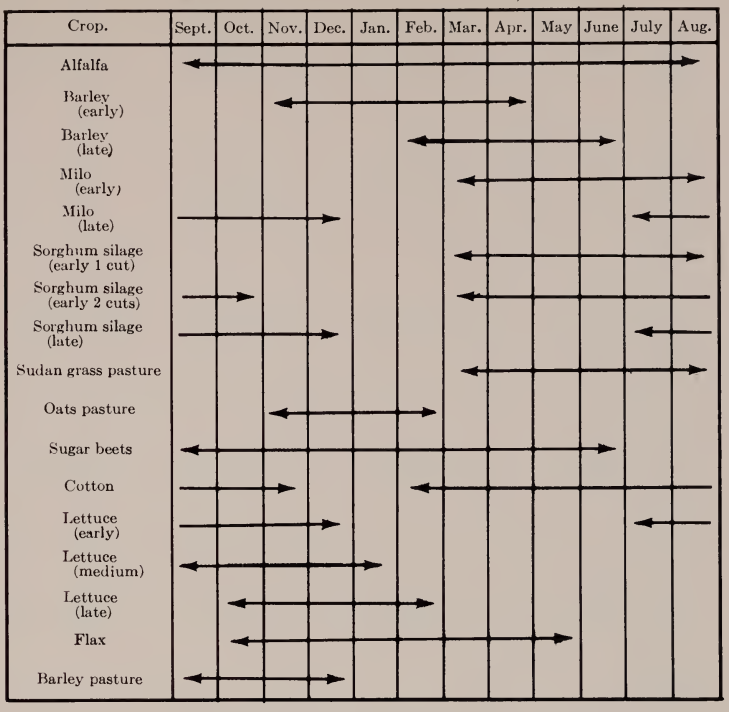
* Crops used in cattle feeding show costs only (negative net returns).
† Wage rates are: irrigators $0.80 per hour, and tractor drivers $1.60 per hour.
‡ Includes contract work.
§ Yield times price.
¶ Gross return minus total variable cost.
‖ Includes 852 pounds cottonseed.
** Includes $6.00 for straw.
†† Numerous alfalfa alternatives are possible, depending upon harvest method used and disposal of the feed. Net return will vary from a maximum of $107.88 to a minimum of $67.97 depending upon these factors.
‡‡ Costs include only operations of growing crop. Cost of hauling for greenchop included in cost of feeder operation.

these crops on surveyed farms of this size. Each farmer is restricted to a maximum acreage of cotton specified by government controls. Sugar beets are planted on the basis of contracts with the sugar beet companies. In both cases, crop history determines in large part the size of the allotment or contract.

Flax acreage per farm is limited to 184 acres or less. This maximum restriction is based upon recommendations of agronomists that flax ordinarily should not be grown on the same land more than 2 out of every 5 years because of weed problems. Alfalfa is required, for soil maintenance purposes, to be planted on a minimum of 25 per cent of the tillable land, or 115 acres. (It is assumed that 20 acres out of the total of 480 acres are required for roads, buildings, etc.) From a practical view, these restrictions in the short run need not be rigidly met. However, in the long run, the above rotational restrictions appear reasonable.

TABLE 3

LAND USAGE BY MONTH FOR SELECTED CROPS, IMPERIAL VALLEY



SOURCE: 1959 farm survey conducted by authors and information provided by Imperial Valley Farm Advisors.

Cattle

Cattle-feeding systems in the Imperial Valley range from various types of pasture feeding to finishing slaughter cattle in feedlots under several alternative rations. This variation in feeding operations may be explained by available feed and crop residues, relative prices of feeds and cattle, the sources, types, and quality of cattle available at different times of the year, and the preferences of individual cattle feeders.

For purposes of this analysis, however, two primary cattle feeding systems are considered: (1) feeding of steer calves to "heavy feeder" weight (defined as 550 to 650 pounds), and (2) feeding heavy feeder steers to finished slaughter weight. Under the first system, 300 to 500 pound calves are brought into the Imperial Valley primarily from the southwestern states and from Mexico. These lower grade (medium to good) cattle—sometimes referred to as "okies" and "crossbreds"—have proved to be efficient converters of roughage under conditions of extremely high temperatures encountered in the Valley. After cattle reach 550 to 650 pounds, the first growing and conditioning feeding program is completed. The animals are then sold (or remain on the same farm) to enter the feedlots for finishing—the second feeding program.

Two feeding periods of approximately 150 days each were established as representing realistic feeding practices for the two general feeding systems described above. Period I (fall) begins about August–October and ends 5 months later. Period II (spring) begins about February–March and continues for 5 months. The two 5-month feeding periods allow for some flexibility for "in" and "out" times between periods, recognizing inevitable time lapses in finding and transporting in the type and number of cattle desired, cleaning pens, etc. For the individual feeder,

TABLE 4

ALTERNATIVE DAILY RATIONS AND NUTRIENT CONTENT, SPRING AND FALL PERIODS, IMPERIAL VALLEY

Ration	Amount	Dry matter	Total digestible nutrients	Digestible protein	Calcium	Phosphorus	Energy	Carotene
		pounds per day					*therms per day*	*mgs per day*
Greenchop								
Grain (½ barley—½ milo)*	3.00	2.69	2.37	0.23	....	0.01	2.25	0.45
Alfalfa hay	2.00	1.81	1.01	0.22	0.03	....	0.81	16.40
Green alfalfa	17.00	4.15	2.52	0.60	0.07	0.01	2.19	481.10
Sorghum silage	17.00	4.32	2.58	0.14	0.01	0.01	2.07	45.90
Total	....	12.97	8.48	1.19	0.11	0.03	7.32	543.85
Fall pasture								
Pasture #1 (alfalfa)								
Grain	3.50	3.12	2.77	0.27	....	0.01	2.61	0.52
Alfalfa hay	3.00	2.72	1.52	0.33	0.04	0.01	1.22	24.60
Alfalfa green	28.30	6.91	4.19	0.99	0.11	0.02	3.65	800.89
Total	....	12.75	8.48	1.59	0.15	0.04	7.48	826.01
Pasture #2 (alfalfa—oats)								
Grain	3.50	3.12	2.77	0.27	....	0.01	2.61	0.52
Alfalfa hay	3.00	2.72	1.52	0.33	0.04	0.01	1.22	24.60
Alfalfa green	9.50	2.32	1.41	0.33	0.04	0.01	1.23	268.85
Oats green	30.70	4.33	2.82	0.74	0.02	0.03	2.46	828.90
Total	....	12.49	8.52	1.67	0.10	0.06	7.52	1,122.87
Pasture #3 (barley—oats)								
Grain	3.50	3.12	2.77	0.27	....	0.01	2.61	0.52
Alfalfa hay	3.00	2.72	1.52	0.33	0.04	0.01	1.22	24.60
Barley green	11.30	2.26	1.41	0.44	0.01	0.01	1.24	236.17
Oats green	30.70	4.33	2.82	0.74	0.02	0.03	2.46	828.90
Total	....	12.43	8.52	1.78	0.09	0.06	7.53	1,090.69

Grain	3.50	3.12	2.77	0.27	....	0.01	2.61	0.52
Alfalfa hay	3.00	2.72	1.52	0.33	0.04	0.01	1.22	24.60
Barley green	11.30	2.26	1.41	0.44	0.01	0.01	1.24	236.17
Alfalfa green	19.10	4.66	2.83	0.67	0.08	0.01	2.46	540.53
Total	....	12.76	8.53	1.71	0.13	0.04	7.53	801.82
Spring pasture								
Pasture #1 (alfalfa)								
Grain	3.50	3.12	2.77	0.27	....	0.01	2.61	0.52
Alfalfa hay	3.00	2.72	1.52	0.33	0.04	0.01	1.22	24.60
Alfalfa green	28.30	6.91	4.19	0.99	0.11	0.02	3.65	800.89
Total	....	12 75	8.48	1.59	0.15	0.04	7.48	826.01
Pasture #2 (beet tops—alfalfa)								
Grain	3.50	3.12	2.77	0.27	....	0.01	2.61	0.52
Alfalfa hay	3.00	2.72	1.52	0.33	0.04	0.01	1.22	24.60
Beet tops green	13.60	2.42	1.41	0.23	0.02	0.01	1.16	.....
Alfalfa green	19.10	4.66	2.83	0.67	0.08	0.01	2.46	540.53
Total	....	12.92	8.53	1.50	0.14	0.04	7.45	565.65
Pasture #3 (alfalfa—Sudan)								
Grain	3.50	3.12	2.77	0.27	....	0.01	2.61	0.52
Alfalfa hay	3.00	2.72	1.52	0.33	0.04	0.01	1.22	24.60
Alfalfa green	9.50	2.32	1.41	0.33	0.04	0.01	1.23	268.85
Sudan green	19.70	4.26	2.82	0.47	0.02	0.02	2.40	423.55
Total	....	12.42	8.52	1.40	0.10	0.05	7.46	717.52
Pasture #4 (beet tops—Sudan)								
Grain	3.50	3.12	2.77	0.27	....	0.01	2.61	0.52
Alfalfa hay	3.00	2.72	1.52	0.33	0.04	0.01	1.22	24.60
Beet tops green	13.60	2.42	1.41	0.23	0.02	0.01	1.16	.....
Sudan green	19.70	4.26	2.82	0.47	0 02	0.02	2.40	423.55
Total	....	12.52	8.52	1.30	0.08	0.05	7.39	448.67

* Percentages used on grain are an average of barley and milo.
SOURCE: See Appendix Table A-2.

a number of alternative programs exist: he can buy calves in either period and carry them to heavy feeder weight on pasture; if he has feedlot facilities, calves can be purchased in either period and fed greenchop in drylot; when the calves reach heavy feeder weight they can be sold or transferred to a finishing feedlot on the same farm; the feeder with a finishing operation can buy either feeders or calves, etc. Of course, combinations of these alternatives also are possible.

Assumptions for Calf-to-Heavy Feeder System

Either pasture feeding or feeding of alfalfa greenchop in a drylot can be used in carrying calves to heavy feeder weight. In Imperial Valley both pasture feeding and greenchop feeding are possible year-round. A number of pasture systems are possible because of the diverse forage crops available at different times of the year. For our analysis, four alternative pasture systems are specified for the fall and spring feeding periods (table 4). The greenchop ration in table 4 may be fed in either period.

The 150-day pasture feeding periods were divided into 60- and 90-day subperiods. During each of the two subperiods a specific crop is pastured and supplemental feeds fed. The time allocation is made under the condition that only alfalfa could be pastured for 150 days. The pasture crops available in fall are barley, oats, and alfalfa, while those for spring are sugar beet tops (where sugar beets are grown for cash), Sudan grass, and alfalfa. Cropping patterns corresponding specifically to the rations in table 4 are:

Fall

1. Alfalfa: 150 days
2. Alfalfa: 60 days—Oats: 90 days
3. Barley: 60 days—Oats: 90 days
4. Barley: 60 days—Alfalfa: 90 days

Spring

1. Alfalfa: 150 days
2. Beet tops: 60 days—Alfalfa: 90 days
3. Alfalfa: 60 days—Sudan grass: 90 days
4. Beet tops: 60 days—Sudan grass: 90 days

Pasture yields in pounds of Total Digestible Nutrients (TDN), by month, are given in Appendix Table A-1.

For these alternatives, medium-grade calves averaging 375 pounds are purchased, fed for 150 days, and sold (or transferred to the finishing lot) at grade "good." This upgrading is consistent with information received in the sample data and with the type of rations specified.

A 1.67-pound average daily gain per head was assumed on all of these calf-to-heavy feeder alternatives, making the average selling weight 625 pounds (net 600 pounds after 4 per cent shrinkage). These daily gains are reasonable under Imperial Valley conditions and green feeding practices. The formula derived (equation 1) by Garrett, *et al.* (1959) relating per day TDN consumption and the weight of the animal to daily gain, was used to determine the necessary TDN consumption in each of the 60- and 90-day subperiods to produce a 1.67-pound average daily gain.

(1) $TDN = 0.0331W^{0.75}(1.48)^{G}$

where TDN = daily intake of Total Digestible Nutrients in pounds (Morrison, 1957),

W = weight of animal in pounds,
G = daily gain in pounds.

In equation (1), concentrates were assessed at full Morrison value while roughages were assessed at 75 per cent of Morrison for daily gain calculations. Specifically, the procedure was to integrate equation (1) T = time in days), setting G = 1.67 and W = 375 + 1.67T over the two periods to yield the total TDN requirement per feeder for each time period.

(2a) $TDN_{60\ days} = \int_0^{60} 0.0331(1.48)^{1.67}[375 + 1.67T]^{0.75}dT$ = TDN required of supplements and 60-day pasture crop.

(2b) $TDN_{90\ days} = \int_0^{90} 0.0331\ (1.48)^{1.67}[475 + 1.67T]^{0.75}dT$ = TDN required of supplements and 90-day pasture crop.

The TDN accounted for by the dry feed portion of each ration was then subtracted from these derived TDN requirements and the remaining amount assumed as obtained

from green feed consumption. The average consumption level of dry matter so derived is consistent with the average weight of the animal over the feeding period.[3]

Assumptions for Feeding to Slaughter Weight in Drylot

The finish-feeding program is designed to produce a slaughter steer weighing 900 to 1,100 pounds of good to choice grade. As stated above, the initial weight of the heavy feeder steer is 625 pounds at good grade. The feeding takes place entirely in drylot; the feeds are milled and delivered to the cattle with feed wagons. The program terminates at the conclusion of 150 days when the slaughter weight and grade are attained.

Since feed costs are a large proportion of total costs for cattle in a finishing feedlot, the selection of the most profitable ration is critical. Thus, four alternative rations, reflecting wide variation in concentrate-roughage ratios, are formulated as shown in tables 5 and 6. The cumulative rations in table 5 are averages of the feeds fed over the time period; they are derived from a set of specified component rations fed for various lengths of time in the feeding period, as indicated in table 6. The high concentrate ration (cumulative ration #1) is not as concentrated as some rations fed in commercial feedlots. However, we are dealing with a long feeding period of 150 days whereas higher concentrate rations are usually fed only for about 90 days. In fact, the ration fed during the last 30 days (cumulative ration #1, table 6) is nearing the all-concentrate level. Also, we are analyzing smaller farm feedlots which may not exercise the close supervision necessary to locate cattle off feed or doing poorly on extremely high concentrate rations fed over an extended period.

The varying concentrate-roughage ratios cause TDN consumption levels to vary among the four rations; consequently, there are four different daily gain and corresponding finish weights. Average daily gains were established by first estimating total TDN intake over the entire feeding period and then, by successive calculations with equation (1), deriving the daily gain which is consistent with the animal's average weight and TDN consumption for that ration. The gain figures in table 5 are the resultant averages for the 150-day feeding period.

The steers from all four rations are assumed to be upgraded to finish 50 per cent choice and 50 per cent good. The market weights varied from 888 to 984 pounds (after a 4 per cent shrink) depending on the ration fed (table 7). The assumption of uniform grades among rations tends to give a bias in favor of the lower concentrate rations, but experimental data explicitly relating grade to ration fed are not readily available. Therefore, rather than arbitrarily set grade differentials for different rations it seemed advisable to make a standard assumption with respect to grade and then examine (in a later section) the effects of different grades on net returns.

Price Assumptions

The profit from feeding cattle depends upon price in two ways—the purchase-sale margin and the absolute price level. Both

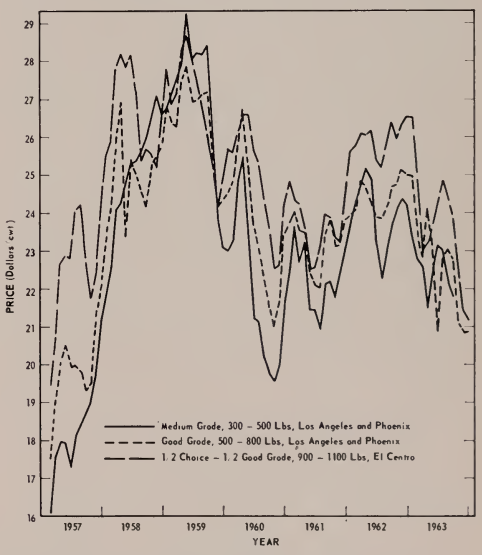


Fig. 1. Price movements for feeder and slaughter steers by months, 1956–63.

[3] A 25 per cent wastage factor was assumed for calves on pasture programs and was calculated as follows:
Grain TDN + hay TDN + pasture TDN + ⅓ pasture TDN = Total requirement for programming analysis.

Example: Table 4, pasture ration 1

2.77 + 1.52 + 4.19 + ⅓ (4.19) = 9.88 = total daily requirement for programming analysis.

TABLE 5

ALTERNATIVE CUMULATIVE FINISHING RATIONS AND NUTRIENT CONTENT (DAILY)

Ration	Amount	Dry matter	TDN*	Digestible protein	Calcium	Phosphorus	Energy	Carotene	Daily gain
	pounds per day						*therms per day*	*mgs per day*	*pounds*
Cumulative #1									2.67
Alfalfa hay	10.08	9.122	5.111	1.099	0.148	0.024	4.092	82.656	
(Barley-milo)†	11.66	10.436	9.211	0.897	0.005	0.035	8.745	1.749	
C.S.M.‡	1.13	1.046	0.814	0.381	0.002	0.011	0.864	0.113	
Molasses	1.13	0.910	0.678	0.050	0.001	.....	0.634	.....	
	.....	21.514	15.814	2.427	0.156	0.070	14.335	84.518	
Cumulative #2									2.38
Alfalfa hay	12.24	11.077	6.206	1.334	0.180	0.029	4.969	100.368	
(Barley-milo)	8.34	7.464	6.589	0.642	0.004	0.025	6.255	1.251	
C.S.M.	1.13	1.046	0.814	0.381	0.002	0.011	0.864	0.113	
Molasses	1.13	0.910	0.678	0.050	0.001	.....	0.634	.....	
	.....	20.497	14.287	2.407	0.187	0.065	12.722	101.732	
Cumulative #3									2.12
Alfalfa hay	15.72	14.227	7.860	1.713	0.231	0.038	6.382	128.904	
(Barley-milo)	5.15	4.615	4.069	0.397	0.003	0.016	3.849	0.774	
C.S.M.	1.10	1.019	0.792	0.371	0.002	0.011	0.842	0.110	
Molasses	1.10	0.886	0.660	0.048	0.001	.....	0.617	.....	
	.....	20.747	13.381	2.529	0.237	0.065	11.690	129.788	
Cumulative #4									2.00
Sorghum silage	47.17	11.981	7.169	0.377	0.038	0.024	5.755	127.359	
(Barley-milo)	5.15	4.615	4.069	0.397	0.003	0.016	3.849	0.774	
C.S.M.	1.10	1.019	0.792	0.371	0.002	0.011	0.842	0.110	
Molasses	1.10	0.886	0.660	0.048	0 001	.....	0.617	.....	
	.....	18.501	12.690	1.193	0.044	0.051	11.063	128.243	

* Total digestible nutrients.
† ½ barley—½ milo.
‡ Cottonseed meal.
SOURCE: See Appendix Table A-2.

TABLE 6
COMPONENT RATIONS OF CUMULATIVE FINISH RATIONS (DAILY)

Component rations	Number of days component ration fed	Cumulative ration #1, high concentrate	Cumulative ration #2, medium concentrate	Cumulative ration #3, low concentrate	Cumulative ration #4, low concentrate
		pounds per day			
Beginning ration feeds	10				
Grain		3 50	3.50	3.50	3.50
Alfalfa hay		14.00	14.00	14.00	
C. S. M.					
Molasses					
Sorghum silage					42.00
Intermediate ration feeds	110				
Grain		9.75	6.39	4.50	4.50
Alfalfa hay		11.31	13.09	15.75	
C. S. M.		1.16	1.16	1.13	1.13
Molasses		1.16	1.16	1.13	1.13
Sorghum silage					47.25
Finish ration feeds	30				
Grain		21.36	17.10	8.10	8.10
Alfalfa hay		4.28	8.55	16.20	
C. S. M.		1.43	1.43	1.35	1.35
Molasses		1.43	1.43	1.35	1.35
Sorghum silage					48.60

margin and price level are subject to wide variations (figs. 1 and 2). The absolute price movement for the three feeder grades used in the analysis is based upon the Los Angeles and Phoenix markets (see Appendix Tables A-3 and A-4) over the period 1956–63. The average price for medium grade 300 to 500 pound calves and good grade 500 to 800 pound feeders was about $22.50 per hundredweight. The slaughter cattle price (one-half good—one-half choice) was based on the El Centro market over the 1956–63 period (see Appendix Table A-5).

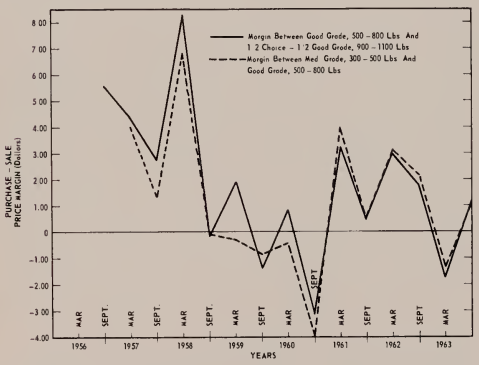


Fig. 2. Five-month margins (April-September, October–March) for the heavy feeder and slaughter steer, 1956–63.

The data presented in figures 1 and 2, and in more detail in Appendix Tables A-3, A-4, and A-5, clearly depict a situation of great variability and uncertainty in cattle price relationships. A recent study (Petit and Dean, 1964) has demonstrated the overriding importance of cattle prices in the selection of optimum livestock plans and in the determination of profits and losses from cattle feeding. Therefore, later sections of this report deal in considerable detail with the effects of different price relationships on farm profits. Because of the great fluctuation in prices, an arithmetic average has little meaning. Accordingly, the results in the initial sections of this report are based on a rather conservative judgment estimate of cattle prices; as mentioned, other relationships are investigated in detail later. In summary, the grades and base prices assumed initially in the analyses are:

Medium grade, 300 to 500 pound calves: $22.50 per hundredweight.

Good grade, 500 to 800 pound feeders: $22.50 per hundredweight.

Good-choice (50:50) grade, 900 to 1,100 pound slaughter steers: $23.00 per hundredweight.

TABLE 7
SUPPLEMENTAL FEED COSTS, NONFEED COSTS, AND NET REVENUES, FOR CATTLE ENTERPRISES, IMPERIAL VALLEY*

Items	Heavy feeder alternatives		Finish alternatives			
	Pasture	Greenchop silage	High concentrate	Medium concentrate	Low (hay) concentrate	Low (silage) concentrate
Initial weight (lbs.)	375	375	625	625	625	625
Average daily gain (lbs.)	1.67	1.67	2.67	2.38	2.12	2.00
Days on feed	150	150	150	150	150	150
Market weight, after 4 per cent shrink (lbs.)	600	600	984	943	905	888
	dollars					
Cost for feeder	84.38	84.38	140.62	140.62	140.62	140.62
Other cash costs per period						
Mill costs†						
Power	.....	.....	0.90	0.90	0.90	0.30
Repair	.....	.....	0.15	0.15	0.15	0.06
Vet fees	1.00	1.00	1.00	1.00	1.00	1.00
Death loss	1.15	1.15	1.90	1.86	1.81	1.79
Protein supplement‡	.....	.....	5.52	5.52	5.36	5.36
Molasses	.....	.....	2.13	2.13	2.06	2.06
Feeding labor§	3.04	4.05	4.05	4.05	4.05	4.05
Machine cost	.....	5.10	0.38	0.38	0.38	1.35
Interest on borrowed capital¶						
Feeder purchased	2.24	2.51	3.91	3.91	3.90	3.91
Feeder transferred	.....	.....	0.40	0.40	0.39	0.40
Total variable cost‖						
Feeder purchased	91.81	97.99	160.56	160.52	160.23	160.50
Feeder transferred	.....	.....	16.43	16.39	16.10	16.37
Total revenue	135.00	135.00	226.32	216.89	208.15	204.24
Net revenue—heavy feeder:						
Feeder sold	43.19	37.01	.....	.....	.....	.....
Feeder transferred	−91.81	−97.99	.....	.....	.....	.....
Net revenue—finish steer:						
Feeder purchased	.....	.....	65.76	56.37	47.92	43.74
Feeder transferred	.....	.....	209.89	200.50	192.05	187.87

* Prices—$22.50 medium (300–500), good (500–800), and $23.00 for ½ choice–½ good (900–1,100).
† King (1962).
‡ Cottonseed meal.
§ Includes both mill and direct feeding labor.
¶ Calculated at 2.5 per cent of variable capital requirements.
‖ Excludes cost of purchased or grown primary feeds.

Thus, it is assumed that there is a zero price margin for calves fed out to heavy feeder weight, and only a 50-cent per hundredweight margin for heavy feeders fed out to finished weight.

Supplemental Feed and Nonfeed Variable Costs

Table 7 summarizes the per head costs of supplemental feed and other variable nonfeed costs for each of the main feeder and finishing alternatives considered. Costs include items which vary proportionately with the number of cattle fed, such as feed mill expenses, labor, death loss, veterinary fees, purchase price of the feeder animal, interest on borrowed capital, and similar items. Overhead costs associated directly with the fixed capital investment in the mill, feedlot, etc., are discussed in the next major section.

Cost of feeder animal. In the heavy feeder alternative situation shown in table 7, 375-

pound calves are purchased for $22.50 per hundredweight, or a cost of $84.38. The feeder animal for the finish alternatives situation may be purchased for $140.62 (625 pounds @ $22.50) or transferred directly to the feedlot after being fed on pasture or greenchop feed up to 625 pounds. In this latter case the "cost of the feeder" includes all costs incurred up to the time it is transferred into the feedlot. For example, if an operator is growing his own cattle on pasture for finishing in the feedlot, he buys the animal for $84.38, incurs additional nonfeed costs of $7.43 and has a total variable cost (excluding primary feeds) of $91.81 at the time he transfers the animal into the feedlot. The costs of the primary feeds fed this animal will depend upon the particular feeding program followed, and will be discussed later.

Labor. Labor costs (table 7) assume labor requirements for pasturing heavy feeders of 0.015 hours per animal per day, based on sample data, published studies dealing with similar problems, and follow-up interviews with selected farm operators. The pasture feeding alternatives all require small quantities of grain fed daily. It is assumed that the grain can be fed in self-feeders with sufficient salt added to control daily grain consumption per animal. Often it is difficult to regulate grain intake with the desired degree of accuracy by this method. If the self-feeding method should prove impractical in a particular situation, daily grain feeding in bunks would be required and labor costs for the pasture alternatives would increase accordingly.

The labor requirements for the greenchop feeding and finishing alternatives are 0.02 hours per animal per day. The labor requirements for all systems, however, are subject to variations due to number of cattle on feed, and distance from the fields to the farm headquarters. Wage rates for this type of labor are typically $1.35 per hour. Based on a 150-day feeding period, labor costs are, therefore, $3.04 per head for pasture animals and $4.05 per head each for greenchop and for finish feeders.

Veterinary and medical fees. The modal cost per animal for veterinary services and medicine over the feeding period, as indicated by the sample feeders, was $1.00 (table 7). However, these costs varied among cattle feeders from $0.05 to $4.23 per animal.

Death loss. The cost per head from death loss (table 7) was based upon a modal figure of 1 per cent. It was assumed that the animal died in the middle of the feeding period. The following equation gives the cost of death loss:

$$C_D = \frac{(W)\,(P)}{100}$$

where

W = initial weight plus ½ gained weight (in pounds),
P = price at conclusion of feeding period (dollars per pound),
C_D = death loss cost per animal (dollars per animal).

Machine and repair costs. The cost of operating and repairing machinery (table 7) is dependent on the hours spent in feeding. The costs per hour of operation for greenchop feeding were taken from Reed (1960). Per-head mill repair costs were estimated from data given by King (1962).

Power. The feed-mill power requirements per head (table 7) were estimated from a series of equations. First, the horsepower of the connected load and the corresponding kilowatt hours per horsepower consumption of electricity was estimated (King, 1962):

(1) $H.P. = 90 + 13r$

(2) $C_{kwh/hp} = shD$

where

H.P. = horsepower of connected load,
r = mill output in tons per hour,
s = kwh per horsepower per hour = 1,
h = hours of operation per day,
D = days of operation,
$C_{kwh/hp}$ = killowatt hours per horsepower consumption.

The rate structure for kilowatt hours per horsepower for connected loads of 100 horsepower or more is:

$$P_e = 6.5\ (h.p.) + h.p.\ (0.0136C_1 + 0.0082C_2 + 0.0064C_3)$$

where

P_c = annual power cost in dollars,
C_1 = first thousand kilowatt hours per horsepower consumption,
C_2 = second thousand kilowatt hours per horsepower consumption,
C_3 = over two thousand kilowatt hours per horsepower consumption,
$C_{kwh/hp} = C_1 + C_2 + C_3$ (Southern California Edison Company, 1957).

Annual power costs were calculated for each capacity and each finishing ration and then averaged for the ration.

Interest on borrowed capital. The manager is assumed to require financing for production credit needs at 6 per cent interest. On the basis of several capital-flow budgets of typical organizations, 2.5 cents per dollar of variable cost was assumed. This implies an average holding of credit capital for a 5-month period.

Primary Feed Costs

The primary feeds (roughage and grain) may be grown or purchased, whichever method is consistent with the maximum net return of the total farming organization. The exceptions are greenchop feeds, silage, and pasture crops which must be produced on the farm if used. Thus, the cost of primary feed to a livestock enterprise may be the purchased price or the variable production costs per acre of the crop providing the feed (table 2). This procedure assures that the "optimum" plan specifies the most profitable crop and livestock plan for the total organization.

FIXED RESOURCES FOR TYPICAL ORGANIZATIONS

The capital investment and annual fixed costs associated with the different crop-livestock plans analyzed in this report are summarized in this section. Investments and fixed costs are presented in terms of a cash crop farm of 480 acres (gross) and 460 acres of cropland as the basic organization. The various livestock feeding programs are considered as requiring net additions or deletions in capital investment from the basic crop organization. Specifically, the following situations are considered:

1. Cash crop operation
2. Crop-pasture feeder operation
3. Crop-greenchop feeder operation
   a. feedlot capacity 1,200 head
   b. feedlot capacity 2,400 head
   c. feedlot capacity 3,600 head
4. Crop-finish feedlot operation
   a. feedlot capacity 1,200 head
   b. feedlot capacity 2,400 head
   c. feedlot capacity 3,600 head
5. Crop—Choice of all livestock alternatives operation
   a. feedlot capacity 1,200 head
   b. feedlot capacity 2,400 head
   c. feedlot capacity 3,600 head.

Land, Machinery, Buildings, and Equipment

Cash Crop Operation

Table 8 indicates the typical investment and annual fixed costs of a 480-acre cash crop operation. Land is valued at $550 per acre—a conservative valuation based on agricultural use. Interest on the land investment is calculated at 6 per cent, totaling $15,840. This approximates what the capital now invested in land could earn if invested elsewhere. The investment estimate for buildings in this situation, as well as in all others, was based on 2,500 square feet (machine shop shed and equipment cover) at $2.00 per square foot.

The machinery list corresponds to a typical field crop farm of this size (Carter and Dean, 1962). Harvesting operations are performed by a combination of owned and custom machinery, depending on the crop. Hay harvest is generally performed

with owned equipment. Grain combining, cotton picking, and sugar beet digging are generally contracted.

Machinery depreciation was estimated on a straight-line basis using useful life and initial cost data presented by Reed (1960). Interest on investment was based on 6 per cent of the average investment (one-half of the initial cost). Taxes and insurance were estimated from the sample data at one per cent of the initial investment.

The total capital investment for the cash crop farm is $327,580. Annual fixed costs for this operation—the summation of depreciation, interest on investment, and taxes and insurance—are $29,073.

Crop-Pasture Feeder Operation

Reorganization of a cash crop farm to allow pasturing for heavy feeder cattle production involves only minor changes in facilities (table 9). Facilities added, which replace specialized hay harvest equipment, include hotwire, grain storage, receiving pens, an extra tractor, and a cattle sprayer.

Crop-Greenchop Feeder Operation

An alternative to raising calves to heavy feeders on pasture is to feed greenchop alfalfa in a feedlot. Three capacity levels for the feedlot are considered: 1,200 head, 2,400 head, and 3,600 head. For the 1,200-head capacity feedlot the additional investment in equipment and facilities over the cash crop farm includes feedlot pens, grain storage, and equipment to chop, haul, and feed greenchop and silage (table 10). An investment of $15.00 per animal for pens is required, assuming 220 square feet loafing space per animal based on the study by King (1962). Two choppers are required. One is for regular use and the second for insurance against unexpected breakdowns.

Expanding the capacity of the lot to 2,400 head requires mainly additional pen facilities over those specified for the 1,200-head lot. An additional pickup truck is included for the livestock foreman.

To further expand to the 3,600-head feedlot, additional pens, a silage loader, trailer feed wagon, and a small tractor are required.

Dust control on all drylot situations is considered essential because of progressively more restrictive laws regarding feedlots. Scales and an office are included on all feedlot operations for feed and livestock weighing and for management purposes.

Crop-Finish Feedlot Operation

Table 11 summarizes the reorganization of capital investment on a crop farm in order to include a feedlot and feed mill for a finishing operation. All changes are additions in capital requirements over that specified for the cropping program alone. Harvesting equipment and equipment essential to the operation of the cash crop farm are required in addition to the pens, grain storage, feed mill, and other facilities that are essential to the finish feeding segment of the organization.

The feed mill represents a typical layout for an operation with capacity of five tons per hour adequate for 3,600 head. (For details of components of the feed mill see Appendix Table A-6.)

Crops-Choice of All Cattle Alternatives

A shift from the crop farm to one with the capability of operating efficiently with all crop and cattle alternatives has the greatest capital investment (table 12). An operation organized in this manner could include either greenchopping or pasturing of feeders, feeding any combination of the four possible finishing rations, and coordinating the entire program. Again, successively higher capacity limits for cattle feeding indicate a need for additional investments in pens and associated feeding facilities.

Capital

The assumption is made that the owner has 100 per cent equity in the land, machinery, buildings, corrals, and feeding facilities. However, credit must be obtained for financing all variable costs from local sources at a yearly interest rate of 6 per cent. As stated earlier, the cash flows through time for several farm organiza-

TABLE 8

CAPITAL INVESTMENT AND ASSOCIATED FIXED COSTS FOR 480-ACRE CASH CROP FARM, IMPERIAL VALLEY

Item	Number of items	Cost per unit	Estimated useful life	Initial investment	Average investment	Depreciation	Interest on investment	Taxes and insurance	Annual fixed cost per item
		dollars	*years*	*dollars*		*dollars per year*			
Land (acres)	480	550.00	..	264,000.00	264,000.00	.....	15,840.00	4,800.00	20,640.00
Buildings (sq. ft.)	2,500	2.00	10	5,000.00	2,500.00	500.00	150.00	50.00	700.00
Automotive									
Pickup	1	2,200.00	5	2,200.00	1,100.00	440.00	66.00	22.00	528.00
Truck—flatbed	1	3,400.00	10	3,400.00	1,700.00	340.00	102.00	34.00	476.00
Trailers	1	1,050.00	5	1,050.00	525.00	210.00	31.50	10.50	252.00
Wagons	1	1,000.00	10	1,000.00	500.00	100.00	30.00	10.00	140.00
Power equipment									
Crawler tractor (75 CDB HP)	1	17,000.00	15	17,000.00	8,500.00	1,133.00	510.00	170.00	1,813.00
Wheel tractors									
(30 CDB HP)	2	3,200.00	10	6,400.00	3,200.00	640.00	192.00	64.00	896.00
(40 CDB HP)	1	5,500.00	10	5,500.00	2,750.00	550.00	165.00	55.00	770.00
Land preparation									
Chisel	1	900.00	10	900.00	450.00	90.00	27.00	9.00	126.00
Disc—up to 8′	1	800.00	5	800.00	400.00	80.00	24.00	8.00	112.00
Disc—10′ to 14′	1	1,400.00	10	1,400.00	700.00	140.00	42.00	14.00	196.00
Harrows—spike 12′	1	115.00	20	115.00	57.50	6.00	3.45	1.15	10.60
Harrows—spring 12′	1	345.00	10	345.00	172.50	34.00	10.35	3.45	47.80
Roller—12′	1	520.00	15	520.00	260.00	35.00	15.60	5.20	55.80
Tool bars—wheel	2	1,500.00	10	3,000.00	1,500.00	300.00	90.00	30.00	420.00
Ditcher	1	800.00	20	800.00	400.00	40.00	24.00	8.00	72.00
Planting and cultivating									
Planters	1	300.00	5	300.00	150.00	30.00	9.00	3.00	42.00
Grain drill	1	900.00	10	900.00	450.00	90.00	27.00	9.00	126.00
Cultivator—2 row	2	350.00	10	700.00	350.00	70.00	21.00	7.00	98.00
Sprayer—300 gallon	1	1,275.00	15	1,275.00	637.50	85.00	38.25	12.75	136.00
Harvesting									
Mower	1	450.00	5	450.00	225.00	90.00	13.50	4.50	108.00
Rake	1	700.00	10	700.00	350.00	70.00	21.00	7.00	98.00
Baler	1	5,800.00	10	5,800.00	2,900.00	580.00	174.00	58.00	812.00
Bale loader	1	600.00	20	600.00	300.00	30.00	18.00	6.00	54.00
Land leveling									
Land plane—10′ × 40′	1	2,700.00	20	2,700.00	1,350.00	135.00	81.00	27.00	243.00
Drag or float	1	225.00	10	225.00	112.50	22.00	6.75	2.25	31.00
Scraper	1	500.00	10	500.00	250.00	50.00	15.00	5.00	70.00
Total	..	.....	..	327,580.00	295,790.00	5,890.00	17,747.40	5,435.80	29,073.20

SOURCE: Data from sample in Imperial Valley 1959, 1962, and consultation with farm advisors, Imperial and Riverside Counties.

TABLE 9

CAPITAL INVESTMENT AND ASSOCIATED FIXED COSTS FOR 480-ACRE CROP-PASTURE OPERATION, IMPERIAL VALLEY

Item	Number of items	Cost per unit	Estimated useful life	Initial investment	Average investment	Depreciation	Interest on investment	Taxes and insurance	Annual fixed cost per item
		dollars	*years*	*dollars*		*dollars per year*			
Items added to typical crop complement (table 8):									
Hotwire (160 acres)	3	500.00	5	1,500.00	750.00	300.00	45.00	15.00	360.00
Grain storage	1	3,000.00	20	3,000.00	1,500.00	150.00	90.00	30.00	270.00
Pens*	1	7,200.00	10	7,200.00	3,600.00	720.00	216.00	72.00	1,008.00
Wheel tractor (30 CDB HP)	1	3,200.00	10	3,200.00	1,600.00	320.00	96.00	32.00	448.00
Cattle sprayer	1	640.00	20	640.00	320.00	32.00	19.20	6.40	57.60
Subtotal	..	.....	..	15,540.00	7,770.00	1,522.00	466.20	155.40	2,143.60
Deletions from typical crop complement:									
Mower	1	450.00	5	450.00	225.00	90.00	13.50	4.50	108.00
Rake	1	700.00	10	700.00	350.00	70.00	21.00	7.00	98.00
Hay baler	1	5,800.00	10	5,800.00	2,900.00	580.00	174.00	58.00	812.00
Bale loader	1	600.00	20	600.00	300.00	30.00	18.00	6.00	54.00
Subtotal	..	.....	..	7,550.00	3,775.00	770.00	226.50	75.50	1,072.00
Total fixed costs of net additions	..	.....	..	**7,990.00**	**3,995.00**	**752.00**	**239.70**	**79.90**	**1,071.60**
Total fixed costs of typical crop complement (table 8):	..	.....	..	**327,580.00**	**295,790.00**	**5,890.00**	**17,747.40**	**5,435.80**	**29,073.20**
Total fixed costs	..	.....	..	**335,570.00**	**299,785.00**	**6,642.00**	**17,987.10**	**5,515.70**	**30,144.80**

* Based on cheaper construction than drylot pens, as they are used for receiving only; based on 2,050 linear feet at $3.50 per foot, including feed-trough facilities.
SOURCE: Data from sample in Imperial Valley 1959, 1962, and consultation with farm advisors, Imperial and Riverside Counties.

TABLE 10

CAPITAL INVESTMENT AND ASSOCIATED FIXED COSTS FOR 480-ACRE CROP-GREENCHOP OPERATION, WITH 1,200-, 2,400, 3,600-HEAD CAPACITY, IMPERIAL VALLEY

Item	Number of items	Cost per unit	Estimated useful life	Initial investment	Average investment	Depreciation	Interest on investment	Taxes and insurance	Annual fixed cost per item
		dollars	*years*	*dollars*		*dollars per year*			
				1,200 head					
Items added to typical crop complement (table 8):									
Feedlot pens and storage:									
Pens	1	18,000.00	10	18,000.00	9,000.00	1,800.00	540.00	180.00	2,520.00
Shades	1	12,000.00	10	12,000.00	6,000.00	1,200.00	360.00	120.00	1,680.00
Horse corrals and horses	1	1,000.00	5	1,000.00	500.00	200.00	30.00	10.00	240.00
Water system	1	2,400.00	10	2,400.00	1,200.00	240.00	72.00	24.00	336.00
Sprayer	1	640.00	20	640.00	320.00	32.00	19.20	6.40	57.60
Grain storage	1	3,000.00	20	3,000.00	1,500.00	150.00	90.00	30.00	270.00
Dust control	1	600.00	10	600.00	300.00	60.00	18.00	6.00	84.00
Feedlot machinery and miscellaneous									
Chopper #1	1	9,600.00	10	9,600.00	4,800.00	960.00	288.00	96.00	1,344.00
Chopper #2	1	4,000.00	10	4,000.00	2,000.00	400.00	120.00	40.00	560.00
Chopper accessories	1	2,300.00	10	2,300.00	1,150.00	230.00	69.00	23.00	322.00
Scales and office	1	10,000.00	20	10,000.00	5,000.00	500.00	300.00	100.00	900.00
Silage loader	1	3,000.00	8	3,000.00	1,500.00	375.00	90.00	30.00	495.00
Grain roller and blower	1	6,500.00	20	6,500.00	3,250.00	325.00	195.00	65.00	585.00
Boiler	1	3,500.00	20	3,500.00	1,750.00	170.00	105.00	35.00	310.00
Scoop attachment	1	1,800.00	10	1,800.00	900.00	180.00	54.00	18.00	252.00
Automotive									
Trailers	2	1,050.00	5	2,100.00	1,050.00	420.00	63.00	21.00	504.00
Feedwagons	2	1,000.00	10	2,000.00	1,000.00	200.00	60.00	20.00	280.00
Total fixed costs of net additions	..	.....	..	**82,440.00**	**41,220.00**	**7,442.00**	**2,473.20**	**824.40**	**10,739.60**
Total fixed costs of typical crop complement (table 8)	..	.....	..	**327,580.00**	**295,790.00**	**5,890.00**	**17,747.40**	**5,435.80**	**29,073.20**
Total fixed costs for 1,200 head	..	.....	..	**410,020.00**	**337,010.00**	**13,332.00**	**20,220.60**	**6,260.20**	**39,812.80**

				2,400 head					
Items added to the 1,200-head complement:									
Feedlot pens and storage:									
Pens	1	18,000.00	10	18,000.00	9,000.00	1,800.00	540.00	180.00	2,520.00
Shades	1	12,000.00	10	12,000.00	6,000.00	1,200.00	360.00	120.00	1,680.00
Water system	1	2,400.00	10	2,400.00	1,200.00	240.00	72.00	24.00	336.00
Dust control	1	600.00	10	600.00	300.00	60.00	18.00	6.00	84.00
Automotive:									
Pickup	1	2,200.00	5	2,200.00	1,100.00	440.00	66.00	22.00	528.00
Total fixed costs of net additions	..	.....	..	**35,200.00**	**17,600.00**	**3,740.00**	**1,056.00**	**352.00**	**5,148.00**
Total fixed costs for 1,200 head	..	.....	..	**410,020.00**	**337,010.00**	**13,332.00**	**20,220.60**	**6,260.20**	**39,812.80**
Total fixed costs for 2,400 head	..	.....	..	**445,220.00**	**354,610.00**	**17,072.00**	**21,276.60**	**6,612.20**	**44,960.80**
				3,600 head					
Items added to the 2,400-head complement:									
Feedlot pens and storage:									
Pens	1	18,000.00	10	18,000.00	9,000.00	1,800.00	540.00	180.00	2,520.00
Shades	1	12,000.00	10	12,000.00	6,000.00	1,200.00	360.00	120.00	1,680.00
Water system	1	2,400.00	10	2,400.00	1,200.00	240.00	72.00	24.00	336.00
Dust control	1	600.00	10	600.00	300.00	60.00	18.00	6.00	84.00
Feedlot machinery and miscellaneous:									
Silage loader	1	3,000.00	8	3,000.00	1,500.00	375.00	90.00	30.00	495.00
Automotive:									
Trailer	1	1,050.00	5	1,050.00	525.00	210.00	31.50	10.50	252.00
Feedwagon	1	1,000.00	10	1,000.00	500.00	100.00	30.00	10.00	140.00
Wheel tractor (30 CDB HP)	1	3,200.00	10	3,200.00	1,600.00	320.00	96.00	32.00	448.00
Total fixed costs of net additions	..	.....	..	**41,250.00**	**20,625.00**	**4,305.00**	**1,237.50**	**412.50**	**5,955.00**
Total fixed costs for 2,400 head	..	.....	..	**445,220.00**	**354,610.00**	**17,072.00**	**21,276.60**	**6,612.20**	**44,960.80**
Total fixed costs for 3,600 head	..	.....	..	**486,470.00**	**375,235.00**	**21,377.00**	**22,514.10**	**7,024.70**	**50,915.80**

SOURCE: Data from sample in Imperial Valley 1959, 1962, and consultation with farm advisors, Imperial and Riverside Counties.

TABLE 11

CAPITAL INVESTMENT AND ASSOCIATED FIXED COSTS FOR A 480-ACRE CROP–ALL FINISH OPERATION, WITH 1,200-, 2,400-, 3,600-HEAD CAPACITY, IMPERIAL VALLEY

Item	Number of items	Cost per unit	Estimated useful life	Initial investment	Average investment	Depreciation	Interest on investment	Taxes and insurance	Annual fixed cost per item
		dollars	*years*	*dollars*		*dollars per year*			
				1,200 head					
Items added to typical crop complement (table 8):									
Feedlot pens and storage:									
Pens	1	18,000.00	10	18,000.00	9,000.00	1,800.00	540.00	180.00	2,520.00
Shades	1	12,000.00	10	12,000.00	6,000.00	1,200.00	360.00	120.00	1,680.00
Horse corrals and horses	1	1,000.00	5	1,000.00	500.00	200.00	30.00	10.00	240.00
Water system	1	2,400.00	10	2,400.00	1,200.00	240.00	72.00	24.00	336.00
Dust control	1	600.00	10	600.00	300.00	60.00	18.00	6.00	84.00
Sprayer	1	640.00	20	640.00	320.00	32.00	19.20	6.40	57.60
Grain storage	6	3,000.00	20	18,000.00	9,000.00	900.00	540.00	180.00	1,620.00
Feedlot machinery and miscellaneous:									
Mill	1	36,710.00	20	36,710.00	18,355.00	1,836.00	1,101.30	376.00	3,313.30
Scales and office	1	10,000.00	20	10,000.00	5,000.00	500.00	300.00	100.00	900.00
Silage loader	1	3,000.00	8	3,000.00	1,500.00	375.00	90.00	30.00	495.00
Automotive:									
Trailers	2	1,050.00	5	2,100.00	1,050.00	420.00	63.00	21.00	504.00
Feedwagons	2	1,000.00	10	2,000.00	1,000.00	200.00	60.00	20.00	280.00
Wheel tractor (30 CDB HP, scoop)	1	5,000.00	10	5,000.00	2,500.00	500.00	150.00	50.00	700.00
Total fixed costs of net additions	..	.....	..	**111,450.00**	**55,725.00**	**8,263.00**	**3,343.50**	**1,123.40**	**12,729.90**
Total fixed costs for a typical crop complement (table 8)	..	.....	..	**327,580.00**	**295,790.00**	**5,890.00**	**17,747.40**	**5,435.80**	**29,073.20**
Total fixed costs for 1,200 head	..	.....	..	**439,030.00**	**351,515.00**	**14,153.00**	**21,090.90**	**6,559.20**	**41,803.10**

				2,400 head					
Items added to 1,200-head complement:									
Feedlot pens and storage:									
Pens	1	18,000.00	10	18,000.00	9,000.00	1,800.00	540.00	180.00	2,520.00
Shades	1	12,000.00	10	12,000.00	6,000.00	1,200.00	360.00	120.00	1,680.00
Water system	1	2,400.00	10	2,400.00	1,200.00	240.00	72.00	24.00	336.00
Dust control	1	600.00	10	600.00	300.00	60.00	18.00	6.00	84.00
Automotive:									
Pickup	1	2,200.00	5	2,200.00	1,100.00	440.00	66.00	22.00	528.00
Total fixed costs of net additions	..	.....	..	**35,200.00**	**17,600.00**	**3,740.00**	**1,056.00**	**352.00**	**5,148.00**
Total fixed costs for 1,200 head	..	.....	..	**439,030.00**	**351,515.00**	**14,153.00**	**21,090.90**	**6,559.20**	**41,803.10**
Total fixed costs for 2,400 head	..	.....	..	**474,230.00**	**369,115.00**	**17,893.00**	**22,146.90**	**6,911.20**	**46,951.10**
				3,600 head					
Items added to 2,400-head complement:									
Feedlot pens and storage:									
Pens	1	18,000.00	10	18,000.00	9,000.00	1,800.00	540.00	180.00	2,520.00
Shades	1	12,000.00	10	12,000.00	6,000.00	1,200.00	360.00	120.00	1,680.00
Water system	1	2,400.00	10	2,400.00	1,200.00	240.00	72.00	24.00	336.00
Dust control	1	600.00	10	600.00	300.00	60.00	18.00	6.00	84.00
Grain storage	3	3,000.00	20	9,000.00	4,500.00	450.00	270.00	90.00	810.00
Feedlot mill and machinery:									
Silage loader	1	3,000.00	8	3,000.00	1,500.00	375.00	90.00	30.00	495.00
Automotive:									
Trailers	1	1,050.00	5	1,050.00	525.00	210.00	31.50	10.50	252.00
Feedwagons	1	1,000.00	10	1,000.00	500.00	100.00	30.00	10.00	140.00
Wheel tractor (30 CDB HP)	1	3,200.00	10	3,200.00	1,600.00	320.00	96.00	32.00	448.00
Total fixed costs of net additions	..	.....	..	**50,250.00**	**25,125.00**	**4,755.00**	**1,507.50**	**502.50**	**6,765.00**
Total fixed costs for 2,400 head	..	.....	..	**474,230.00**	**369,115.00**	**17,893.00**	**22,146.90**	**6,911.20**	**46,951.10**
Total fixed costs for 3,600 head	..	.....	..	**524,480.00**	**394,240.00**	**22,648.00**	**23,654.40**	**7,413.70**	**53,716.10**

SOURCE: Data from sample in Imperial Valley 1959, 1962, and consultation with farm advisors, Imperial and Riverside Counties.

TABLE 12

CAPITAL INVESTMENT AND ASSOCIATED FIXED COSTS FOR A 480-ACRE CROP–ALL CATTLE ALTERNATIVES OPERATION, WITH 1,200-, 2,400-, 3,600-HEAD CAPACITY, IMPERIAL VALLEY

Item	Number of items	Cost per unit	Estimated useful life	Initial investment	Average investment	Depreciation	Interest on investment	Taxes and insurance	Annual fixed cost per item
		dollars	*years*	*dollars*		*dollars per year*			
				1,200 head					
Items added to typical crop complement (table 8):									
Automotive:									
Pickup	1	2,200.00	5	2,200.00	1,100.00	440.00	66.00	22.00	528.00
Trailers	2	1,050.00	5	2,100.00	1,050.00	420.00	63.00	21.00	504.00
Feedwagons	2	1,000.00	10	2,000.00	1,000.00	200.00	60.00	20.00	280.00
Power:									
Scoop	1	1,800.00	10	1,800.00	900.00	180.00	54.00	18.00	252.00
Feedlot pens and storage:									
Pens	1	18,000.00	10	18,000.00	9,000.00	1,800.00	540.00	180.00	2,520.00
Shades	1	12,000.00	10	12,000.00	6,000.00	1,200.00	360.00	120.00	1,680.00
Horse corrals and horses	1	1,000.00	5	1,000.00	500.00	200.00	30.00	10.00	240.00
Water system	1	2,400.00	10	2,400.00	1,200.00	240.00	72.00	24.00	336.00
Sprayer	1	640.00	20	640.00	320.00	32.00	19.20	6.40	57.60
Dust control	1	600.00	10	600.00	300.00	60.00	18.00	6.00	84.00
Grain storage	6	3,000.00	20	18,000.00	9,000.00	900.00	540.00	180.00	1,620.00
Feedlot machinery and miscellaneous:									
Hotwire (160 acres)	3	500.00	5	1,500.00	750.00	300.00	45.00	15.00	360.00
Mill	1	36,710.00	20	36,710.00	18,355.00	1,835.00	1,101.30	367.10	3,303.40
Scales and office	1	10,000.00	20	10,000.00	5,000.00	500.00	300.00	100.00	900.00
Chopper #1	1	9,600.00	10	9,600.00	4,800.00	960.00	288.00	96.00	1,344.00
Chopper #2	1	4,000.00	10	4,000.00	2,000.00	400.00	120.00	40.00	560.00
Total fixed costs of net additions	..	.....	..	**122,550.00**	**61,275.00**	**9,667.00**	**3,676.50**	**1,225.50**	**14,569.00**
Total fixed costs for a typical crop complement (table 8)	..	.....	..	**327,580.00**	**295,790.00**	**5,890.00**	**17,747.40**	**5,435.80**	**29,073.20**
Total fixed costs for 1,200 head	..	.....	..	**450,130.00**	**357,065.00**	**15,557.00**	**21,423.90**	**6,661.30**	**43,642.20**

				2,400 head					
Items added to the 1,200-head complement:									
Automotive:									
Trailer	1	1,050.00	5	1,050.00	525.00	210.00	31.50	10.50	252.00
Wheel tractor (30 CDB HP)	1	3,200.00	10	3,200.00	1,600.00	320.00	96.00	32.00	448.00
Feedlot pens and storage:									
Pens	1	18,000.00	10	18,000.00	9,000.00	1,800.00	540.00	180.00	2,520.00
Shades	1	12,000.00	10	12,000.00	6,000.00	1,200.00	360.00	120.00	1,680.00
Water system	1	2,400.00	10	2,400.00	1,200.00	240.00	72.00	24.00	336.00
Dust control	1	600.00	10	600.00	300.00	60.00	18.00	6.00	84.00
Total fixed costs of net additions	..	.....	..	**37,250.00**	**18,625.00**	**3,830.00**	**1,117.50**	**372.50**	**5,320.00**
Total fixed costs for 1,200 head	..	.....	..	**450,130.00**	**357,065.00**	**15,557.00**	**21,423.90**	**6,661.30**	**43,642.20**
Total fixed costs for 2,400 head	..	.....	..	**487,380.00**	**375,690.00**	**19,387.00**	**22,541.40**	**7,033.80**	**48,962.20**
				3,600 head					
Items added to the 2,400-head complement:									
Automotive:									
Pickup	1	2,200.00	5	2,200.00	1,100.00	440.00	66.00	22.00	528.00
Trailers	1	1,050.00	5	1,050.00	525.00	210.00	31.50	10.50	252.00
Feedwagons	1	1,000.00	10	1,000.00	500.00	100.00	30.00	10.00	140.00
Wheel tractor (30 CDB HP)	1	3,200.00	10	3,200.00	1,600.00	320.00	96.00	32.00	448.00
Land preparation:									
Tool bar (wheel)	1	1,500.00	10	1,500.00	750.00	150.00	45.00	15.00	210.00
Feedlot pens and storage:									
Pens (squeeze)	1	18,000.00	10	18,000.00	9,000.00	1,800.00	540.00	180.00	2,520.00
Shades	1	12,000.00	10	12,000.00	6,000.00	1,200.00	360.00	120.00	1,680.00
Water system	1	2,400.00	10	2,400.00	1,200.00	240.00	72.00	24.00	336.00
Dust control	1	600.00	10	600.00	300.00	60.00	18.00	6.00	84.00
Grain storage	3	3,000.00	20	9,000.00	4,500.00	450.00	270.00	90.00	810.00
Total fixed costs of net additions	..	.....	..	**50,950.00**	**25,475.00**	**4,970.00**	**1,528.50**	**509.50**	**7,008.00**
Total fixed costs for 2,400 head	..	.....	..	**487,380.00**	**375,690.00**	**19,387.00**	**22,541.40**	**7,033.80**	**48,962.20**
Total fixed costs for 3,600 head	..	.....	..	**538,330.00**	**401,165.00**	**24,357.00**	**24,069.90**	**7,543.30**	**55,970.20**

SOURCE: Data from sample in Imperial Valley 1959, 1962, and consultation with farm advisors, Imperial and Riverside Counties.

tions indicated 5 months as the average length of time for holding credit money. Therefore, 2.5 per cent (5/12 × 6 per cent) of the variable costs was estimated as the interest charge.

Labor and Management

Certain types of managerial or supervisory labor as well as bookkeeping tasks become fixed costs, as they cannot be associated directly with crop acres or numbers of animals fed. However, determining the farm size or feedlot capacity at which the supervisory responsibilities become great enough to justify hiring a foreman is somewhat arbitrary. On the basis of the survey data, owner-operators of field crop farms of less than a section of land (640 acres) generally acted as their own foreman. The bookkeeping duties were also performed by a member of the family or by a local accountant. In this size range it was generally found that the owner-operator continued to supervise most of the activities with the addition of small feedlots (those marketing up to 1,200 to 1,500 head). Feedlots of larger sizes generally required at least one foreman. The owner would then either concentrate his time on the livestock and delegate the overseeing of the crops to the foreman or vice versa. Accordingly, in the analysis of this report it is assumed that for a crop farm, and for all crop-livestock operations marketing 1,200 head or less annually, the owner-operator has exclusive responsibility over all of the managerial and supervisory tasks. For any programs involving livestock feeding of more than 1,200 head annually, the owner employs one full-time foreman at a yearly salary of $7,200. Bookkeeper services are employed on the following basis: (1) crop farm only—local accountant services at $300 per year; (2) crop-livestock programs marketing less than 1,200 head—bookkeeper employed 50 per cent of the time at $2,400 per year; and (3) crop-livestock programs with greater than 1,200 head—full-time bookkeeper at $4,800 per year.

Other full-time, part-time, and seasonal labor are employed for crop and livestock production at prevailing wage rates. Additional details on this type of labor were given in the sections on crop and livestock production alternatives.

Summary of Investment and Annual Fixed Costs

Table 13 summarizes the total investment and fixed costs associated with different crop-livestock plans. The investment required to shift from a cash cropping program to a crop-pasture plan is relatively small—from $327,580 to $335,570. The crop-greenchop organization requires a considerably larger investment, however—totaling $410,020 to $486,470, depending on feedlot capacity. The capital investment to install a finishing feedlot with a feed mill and the related facilities amounts to from $439,030 to $524,480 depending on the feedlot capacity. This represents an increase in capital investment from the basic crop plan of $111,450 at the 1,200-head capacity level, $146,650 at the 2,400-head and $196,900 at the 3,600-head level. Investment requirements are slightly higher for the crop-choice of all livestock alternatives plans. The magnitude of these investment requirements for the various crop-livestock plans emphasizes the importance of considering the economic feasibility of such adjustments before taking steps to implement such changes.

Similarly, the annual fixed costs increase rapidly when the various livestock organizations are incorporated with the cash crop systems. While not all fixed costs are immediate cash commitments (e.g., interest on investment and depreciation), they should be covered in the long run.

RESULTS OF THE ANALYSIS

The next sections of the report summarize the optimum or most profitable crop-livestock organizations as determined by linear programming analysis. Costs and returns for each program are summarized to provide the basis for computing net income or earning measures. The two standardized earning measures commonly used are net farm income and management income, defined as follows:

TABLE 13

SUMMARY OF CAPITAL INVESTMENT AND FIXED COSTS FOR DIFFERENT CROP-LIVESTOCK ORGANIZATIONS

Organization	Land and buildings		Automotive, power equipment, and feedlot machinery		Other machinery and equipment		Feedlot pens and storage		Management labor	Total	
	Investment	Fixed cost	Investment	Fixed cost	Investment	Fixed cost	Investment	Fixed cost	Fixed cost	Investment	Fixed costs
	dollars	*dollars per year*	*dollars*	*dollars per year*	*dollars*	*dollars per year*	*dollars*	*dollars per year*	*dollars per year*	*dollars*	*dollars per year*
Cash crop farm	269,000	21,340	36,550	4,875	22,030	2,858	.....	.....	300	327,580	29,373
Crop—pasture	269,000	21,340	40,390	5,381	14,480	1,786	11,700	1,638	12,000	335,570	42,145
Crop—greenchop											
1,200 head capacity	269,000	21,340	81,350	10,427	22,030	2,858	37,640	5,188	12,000	410,020	51,813
2,400 head capacity	269,000	21,340	83,550	10,955	22,030	2,858	70,640	9,808	12,000	445,220	56,961
3,600 head capacity	269,000	21,340	91,800	12,290	22,030	2,858	103,640	14,428	12,000	486,470	62,916
Crop—all finish											
1,200 head capacity	269,000	21,340	95,360	11,067	22,030	2,858	52,640	6,538	12,000	439,030	53,803
2,400 head capacity	269,000	21,340	97,560	11,595	22,030	2,858	85,640	11,158	12,000	474,230	58,951
3,600 head capacity	269,000	21,340	105,810	12,930	22,030	2,858	127,640	16,588	12,000	524,480	65,716
Crop—all alternatives											
1,200 head capacity	269,000	21,340	104,960	12,546	22,030	2,858	54,140	6,898	12,000	450,130	55,642
2,400 head capacity	269,000	21,340	109,210	13,246	22,030	2,858	87,140	11,518	12,000	487,380	60,962
3,600 head capacity	269,000	21,340	116,660	14,614	23,530	3,068	129,140	16,948	12,000	538,330	67,970

Net farm income = total revenue (gross income) minus variable costs minus fixed costs (excluding interest on investment). In essence, this figure represents a return for the operator's management and invested capital.

Management income = net farm income minus interest on investment. This figure represents a residual income for the owner's management after paying or computing a cost for all other factors of production at the market rate.

Other information summarized in the optimum plan (tables 14 to 25) can be easily related to the discussion in previous sections. The numbers in parentheses for each pasture and greenchop feeding program refer to the rations defined in table 4. Similarly, numbers for the plans with finishing rations denote ration compositions in tables 5 and 6. Variable costs per unit for crop and cattle enterprises were developed in tables 2 and 7, respectively. Annual fixed costs for the different plans were defined in tables 8 through 12 and summarized in table 13.

Optimum Plan and Returns for Cash Crop Farm Without Livestock

Table 14 shows optimum organization, costs, returns, and maximum income level for a 480-acre cash crop farm in Imperial Valley, California. Cotton and sugar beets are the two most profitable cash crops and both are planted to a maximum of the allotment or contract assumed. Lettuce (leased out) and milo are double cropped on 115 acres, with the remaining 201 acres planted to alfalfa.

Income over variable costs for the optimum cropping system without livestock amounts to $58,418. Net farm income (return for management and capital invested) is $46,792 and management income $29,044. It is assumed throughout the analysis that the operator has 100 per cent equity in the land and machinery investment. If the operator has less equity in his land and equipment (say, 75 per cent), the only difference in the results would be that the 6 per cent interest imputed to capital investment would become a cash cost for the unowned portion (25 per cent in this case) of the total investment. Thus, of the total $17,747 interest on investment (table 14), $4,437 would become a cash cost and the farmer's net cash income would decline by a like amount. (Net farm income and management income would remain the same.) Of course, mortgage payments would also have to be met from farm earnings.

Cash and crop-share rentals (for a total farming operation) in Imperial Valley are quite close to the interest on investment charge for owned land (i.e., $550 per acre at 6 per cent = $33 per acre). Hence, it is easy to translate the results of table 14 into terms applicable to the renter operator. In this case the entire $17,747 interest on investment figure would instead approximate the cash or share rental. Thus, while net farm income and management income would remain essentially unchanged, the renter's net cash income would be $17,747 less. From this point forward it is assumed that the reader can easily translate the costs and returns presented into various equity and rental situations of interest.

Optimum Plan and Returns for Crop-Pasture Feeder Operation

Table 15 summarizes the most profitable program where the alternative of pasturing feeders is allowed to compete with growing cash crops. Surprisingly, under the price, yield, and other assumptions of the study outlined earlier, the highest income is achieved when all of the land is used for pasturing feeders rather than for raising cash crops. Crops in the optimum plan include 419 acres of alfalfa (all pastured),

TABLE 14

OPTIMUM ENTERPRISE COMBINATION FOR A CROP FARM, IMPERIAL VALLEY

Item	Unit	Number of units	Variable cost per unit	Total variable cost	Total revenue per unit	Total revenue	Net revenue	Summary farm costs and returns
			*dollars**					
Cotton	acres	72	290	20,873	475	34,193	13,320	
Sugar beets	acres	72	181	13,032	323	23,255	10,223	
Lettuce	acres	115	..	.....	65	7,475	7,475	
Milo	acres	115	42	4,888	92	10,580	5,692	
Alfalfa	acres	201	68	13,662	176	35,370	21,708	
Total revenue	.....	...	..	.....	...	110,872	.....	110,872
Total variable cost	.....	...	..	52,454	...	.....	.....	52,454
Total annual fixed cost	.....	...	..	.....	...	.....	.....	29,373
Depreciation	.....	...	..	.....	...	.....	.....	5,890
Interest on investment	.....	...	..	.....	...	.....	.....	17,747
Taxes and insurance	.....	...	..	.....	...	.....	.....	5,436
Foreman and bookkeeping	.....	...	..	.....	...	.....	.....	300
Income over variable costs	.....	...	..	.....	...	.....	58,418	58,418
Net farm income	.....	...	..	.....	...	.....	.....	46,792
Management income	.....	...	..	.....	...	.....	.....	29,045

* Original computations rounded to nearest dollar.

and 41 acres of Sudan grass double cropped with oat pasture. When supplemented with purchased grain and straw, this cropping program will support 1,554 head of feeders in the fall and 2,392 head in the spring. Two separate pasture programs are specified in the fall and two in the spring; alfalfa pasture is the mainstay, supplemented by oat and Sudan pasture, depending on the time sequence of yields for each (see tables 3 and A-1). The profitability of carrying calves to feeder weight on pasture is indicated by the net income figures of $67,793, a gain of $20,901 over the cash crop operation. Management income is also substantially increased from that for cash crops only.

The experienced Imperial Valley operator will quickly raise doubts about a plan which eliminates cotton production. In Imperial Valley, cotton generally is considered the highest profit crop in the low-to-medium risk category and may even be more profitable than many of the higher risk crops such as vegetables. Furthermore, cotton allotments are government controlled and failure to plant can lead to eventual loss or reduction of the base allotment. Thus, the operator might understandably be reluctant to forego his cotton operation in favor of pasture, even though profit in that particular year might be maximized through a pasture-livestock operation. Furthermore, pasture outcompetes cotton in this case only in the special sense that total cropland is limited to 460 acres on the farm. If the farmer could, instead of raising all his own alfalfa pasture, rent 72 acres of alfalfa land nearby (probably for about $60 per acre on a year-round basis) and plant his 72-acre cotton allotment on his own land (net return = $185 per acre), he could increase his net farm income by almost $12,000 per year. (This includes the saving of about $41 per acre on alfalfa not grown, and does not include any extra costs of handling or moving cattle to a nearby farm.)

Even if land cannot be rented nearby, the operator may still select a pasture plan including his 72-acre cotton allotment. This decision may be based on fear of losing the allotment and a desire to reduce risk from a program so heavily committed to livestock. Table 16 presents such a plan. The inclusion of 72 acres of cotton reduces pasture acreage in alfalfa by 66 acres, and by 6 acres in Sudan grass-oats double cropped. This reduction in pasture feed reduces the total number of feeders by 618 head (table 15). Forcing cotton into the plan reduces net farm income and management income by only $1,509. Thus, the plan including cotton can be selected with little sacrifice in expected income level, while reducing risk. Additional analyses are made later showing the effect on net farm income of various prices, margins, and feed efficiency levels for the pasture feeder operation.

Optimum Plan and Returns for Crop-Greenchop Feeder Operation

Greenchop feeding is an alternative to pasture feeding as a method of raising calves to feeder weight. Reductions in feed wastage and possible increases in feed conversion and/or gains per day due to confinement feeding with greenchop must be weighed against the additional cost of the feedlot facilities and the costs of equipment and labor involved in cutting and hauling greenchop to the lot. Analyses of greenchop operations with feedlot capacities of 1,200, 2,400, and 3,600 head follow.

1,200-Head Capacity

With a 1,200-head capacity feedlot the optimum plan is to keep the lot full in both fall and spring (table 17). Sufficient alfalfa greenchop and sorghum silage can be produced on the farm to support 1,200 head in both periods and still leave land for planting the 72-acre cotton allotment, 58 acres of sugar beets and 115 acres of lettuce land leased out after the early-cut sorghum is ensiled. The 200 acres of alfalfa is sufficient to provide the required amount of greenchop in the fall. In spring, when alfalfa yields are considerably higher, there is an excess of alfalfa produced and 714 tons are baled, of which 360 tons are fed and 354 tons sold. As in all the greenchop plans, it is more economical to buy the grain required (540 tons) than to sub-

TABLE 15

OPTIMUM ENTERPRISE COMBINATION FOR A FARM WITH CROP AND PASTURE ALTERNATIVES, IMPERIAL VALLEY

Item	Unit	Number of units	Variable cost per unit	Total variable cost	Total revenue per unit	Total revenue	Net revenue	Summary farm costs and returns
			*dollars**					
Fall feeding								
Alfalfa pasture #1	head	1,188	92	109,070	135	160,380	51,310	.....
Alfalfa-oat pasture #2	head	366	92	33,602	135	49,410	15,808	.....
Spring feeding								
Alfalfa pasture #1	head	2,041	92	187,384	135	275,535	88,151	.....
Alfalfa-Sudan pasture #3	head	351	92	32,225	135	47,385	15,160	.....
Crops								
Alfalfa pasture	acres	419	41	17,321	...	.....	.....	.....
Oat pasture	acres	41	39	1,615	...	.....	.....	.....
Sudan pasture	acres	41	45	1,845	...	.....	.....	.....
Buy feed								
Buy alfalfa hay	tons	226	26	5,863	...	.....	.....	.....
Grain	tons	1,036	46	47,161	...	.....	.....	.....
Bale alfalfa hay (3 cuttings)	acres	207	13	2,757	...	.....	.....	.....
Total revenue	.....	...	..	.....	...	532,710	.....	532,710
Total variable cost	.....	...	..	438,845	...	.....	.....	438,845
Total annual fixed cost	.....	...	..	.....	...	.....	.....	44,059
Depreciation	.....	...	..	.....	...	.....	.....	6,642
Interest on investment	.....	...	..	.....	...	.....	.....	17,987
Taxes and insurance	.....	...	..	.....	...	.....	.....	5,516
Interest on borrowed capital	.....	...	..	.....	...	.....	.....	1,914
Foreman and bookkeeping	.....	...	..	.....	...	.....	.....	12,000
Income over variable costs	.....	...	..	.....	...	.....	93,865	93,865
Net farm income	.....	...	..	.....	...	.....	.....	67,793
Management income	.....	...	..	.....	...	.....	.....	49,806

* Original computations rounded to nearest dollar.

TABLE 16

OPTIMUM ENTERPRISE COMBINATION FOR A FARM WITH COTTON AND PASTURE ALTERNATIVES, IMPERIAL VALLEY

Item	Unit	Number of units	Variable cost per unit	Total variable cost	Total revenue per unit	Total revenue	Net revenue	Summary farm costs and returns
			*dollars**					
Fall feeding								
Alfalfa pasture #1	head	1,002	92	91,994	135	135,270	43,276	.....
Alfalfa-oat pasture #2	head	308	92	28,277	135	41,580	13,303	.....
Spring feeding								
Alfalfa pasture #1	head	1,722	92	158,097	135	232,470	74,373	.....
Alfalfa-Sudan pasture #3	head	296	92	27,176	135	39,960	12,784	.....
Crops								
Alfalfa	acres	353	41	14,593	...	.....	.....	.....
Oat pasture	acres	35	39	1,379	...	.....	.....	.....
Sudan pasture	acres	35	45	1,575	...	.....	.....	.....
Cotton	acres	72	290	20,873	475	34,193	.....	.....
Buy feed								
Grain	tons	873	46	39,722	...	.....	.....	.....
Alfalfa hay	tons	190	26	4,940	...	.....	.....	.....
Bale alfalfa hay (3 cuttings)	acres	175	13	2,331	...	.....	.....	.....
Total revenue	.....	...	..	.....	...	483,473	.....	483,473
Total variable cost	.....	...	..	390,956	...	.....	.....	390,956
Total annual fixed cost	.....	...	..	.....	...	.....	.....	44,280
Depreciation	.....	...	..	.....	...	.....	.....	6,642
Interest on investment	.....	...	..	.....	...	.....	.....	17,987
Taxes and insurance	.....	...	..	.....	...	.....	.....	5,516
Interest on borrowed capital	.....	...	..	.....	...	.....	.....	2,135
Foreman and bookkeeping	.....	...	..	.....	...	.....	.....	12,000
Income over variable costs	.....	...	..	.....	...	.....	.....	92,517
Net farm income	.....	...	..	.....	...	.....	.....	66,284
Management income	.....	...	..	.....	...	.....	.....	48,237

* Original computations rounded to nearest dollar.

TABLE 17

OPTIMUM ENTERPRISE COMBINATION FOR A FARM WITH CROPS AND 1,200 FEEDERS WITH GREENCHOP ALTERNATIVES, IMPERIAL VALLEY

Item	Unit	Number of units	Variable cost per unit	Total variable cost	Total revenue per unit	Total revenue	Net revenue	Summary farm costs and returns
			*dollars**					
Fall greenchop	head	1,200	98	117,588	135	162,000	44,412	.....
Spring greenchop	head	1,200	98	117,588	135	162,000	44,412	.....
Crops								
Alfalfa	acres	200	41	8,268	...	.....	.....	.....
Lettuce lease	acres	115	..	.....	65	7,475	7,475	.....
Sorghum silage (early 1 cut)	acres	115	61	6,992	...	.....	.....	.....
Sorghum silage (early 2 cuts)	acres	15	78	1,174	...	.....	.....	.....
Sugar beets	acres	58	181	10,498	323	18,733	8,235	.....
Cotton	acres	72	290	20,873	475	34,193	13,320	.....
Buy—sell—bale								
Buy grain	tons	540	46	24,570	...	.....	.....	.....
Sell hay	tons	354	..	.....	26	9,204	9,204	.....
Bale hay (3 cuttings)	acres	66	13	879	...	.....	.....	.....
Bale hay (6 cuttings)	acres	83	27	2,210	...	.....	.....	.....
Total revenue	.....	...	..	.....	...	393,605	.....	393,605
Total variable cost	.....	...	..	310,640	...	.....	.....	310,640
Total annual fixed cost	.....	...	..	.....	...	.....	.....	53,699
Depreciation	.....	...	..	.....	...	.....	.....	13,332
Interest on investment	.....	...	..	.....	...	.....	.....	20,221
Taxes and insurance	.....	...	..	.....	...	.....	.....	6,260
Interest on borrowed capital	.....	...	..	.....	...	.....	.....	1,887
Foreman and bookkeeping	.....	...	..	.....	...	.....	.....	12,000
Income over variable costs	.....	...	..	.....	...	.....	82,965	82,965
Net farm income	.....	...	..	.....	...	.....	.....	49,486
Management income	.....	...	..	.....	...	.....	.....	29,265

* Original computations rounded to nearest dollar.

stitute grain for cotton, sugar beets, or other crops in the rotation.

A comparison of net farm incomes and management incomes of the greenchop plan (table 17) and the earlier pasture plan (tables 15 and 16) shows an advantage of about $17,000 per year for the pasture operation under the conditions assumed. In fact, the greenchop plan at this feeding level offers no income advantage over the optimum cash crop operation (table 14)—net farm and management incomes are about equal in the two cases. Further, the cash crop operation requires less investment, probably less risk, and less diversified demands on management ability.

2,400-Head Capacity

When the feedlot capacity is increased to 2,400 head, the lot is filled to capacity only in spring (table 18). The number of cattle fed in the fall is limited by the greenchop furnished by 247 acres of alfalfa in that period. While more cattle could be fed in this period by increasing alfalfa acreage, it is more profitable to plant the 72-acre cotton allotment and only partially fill the lot in fall. Sufficient sorghum silage is produced to feed this number of cattle. The excess hay furnished in spring by the 247 acres of alfalfa is baled and fed. However, an additional 80 tons must be purchased to meet alfalfa hay requirements in the greenchop ration. All grain required (873 tons) is purchased rather than raised on the farm.

Increasing the feedlot capacity from 1,200 to 2,400 head resulted in only very slight increases in net farm and management income. While income over variable cost increased about $9,000, the annual fixed costs for the expanded facilities also increased substantially, making the net increase in net farm income only about $4,400 and the net increase in management income only about $3,400. Again, the small increases in earnings over the optimum cash crop operation (table 14) are not likely to be large enough to induce many farmers to build the 2,400-head capacity feedlot for greenchop feeding.

3,600-Head Capacity

Table 19 summarizes the optimum crop-greenchop feeding plan with drylot and feeding equipment expanded to the 3,600-head capacity level. The number of cattle on feed in each period is less than the capacity of the lots, indicating that feed and livestock numbers are limited by the cropland available. The total 460 acres of land is divided between alfalfa (289 acres) and sorghum silage (early two-cuttings) in the proportions required to satisfy the greenchop ration (table 4). In this case, cotton is forced from the plan by the livestock-greenchop activities. However, as pointed out in pasture feeding, many operators would either rent alfalfa land or take a slight cut in net income in order to maintain their cotton allotment. Large quantities of both hay and grain are purchased.

Income over variable costs for this plan is increased somewhat from the counterpart plan with 2,400-head capacity, but annual fixed charges increase even more, with the result that net farm income ($51,127) actually declines compared with the 2,400-head capacity plan ($53,929). However, since the acreage (460 acres) is too small to support the full 3,600-head capacity of the feedlot and feeding facilities, part of the capital invested is unused. A reduction in investment to match cattle numbers in table 19 makes the income levels of the 2,400-head and 3,600-head plans about equal.

Several points can be made in summary. First, a comparison of the net income levels for the three sizes of feedlots for greenchop feeding indicate little economic incentive for increasing capacity beyond 1,200 head. Second, given the standard base assumptions of the report, growing calves to feeder weight on pasture provides much higher incomes than bringing greenchop to the calves in drylot. In terms of net returns per head, pasture feeding and greenchop feeding are about comparable. But the added fixed costs associated with a greenchop setup make it less profitable under the assumptions of this analysis. Third, none of the greenchop plans offers a significant increase in income over a well-planned cash crop operation.

TABLE 18

OPTIMUM ENTERPRISE COMBINATION FOR A FARM WITH CROPS AND 2,400 FEEDERS WITH GREENCHOP ALTERNATIVES, IMPERIAL VALLEY

Item	Unit	Number of units	Variable cost per unit	Total variable cost	Total revenue per unit	Total revenue	Net revenue	Summary farm costs and returns
			*dollars**					
Fall greenchop	head	1,478	98	144,829	135	199,530	54,701	.....
Spring greenchop	head	2,400	98	235,176	135	324,000	88,824	.....
Crops								
Sorghum silage (early 2 cuts)	acres	141	78	11,035	...	.....	.....	.....
Alfalfa	acres	247	41	10,211	...	.....	.....	.....
Cotton	acres	72	290	20,873	475	34,193	13,320	.....
Buy—sell—bale								
Bale (6 cuttings)	acres	14	27	373	...	.....	.....	.....
Bale (3 cuttings)	acres	130	13	1,732	...	.....	.....	.....
Buy grain	tons	873	46	39,703	...	.....	.....	.....
Buy alfalfa hay	tons	80	26	2,080	...	.....	.....	.....
Total revenue	.....	...	..	.....	...	557,723	.....	557,723
Total variable cost	.....	...	..	466,011	...	.....	.....	466,011
Total annual fixed cost	.....	...	..	.....	...	.....	.....	59,058
Depreciation	.....	...	..	.....	...	.....	.....	17,072
Interest on investment	.....	...	..	.....	...	.....	.....	21,277
Taxes and insurance	.....	...	..	.....	...	.....	.....	6,612
Interest on borrowed capital	.....	...	..	.....	...	.....	.....	2,098
Foreman and bookkeeping	.....	...	..	.....	...	.....	.....	12,000
Income over variable costs	.....	...	..	.....	...	.....	91,711	91,711
Net farm income	.....	...	..	.....	...	.....	.....	53,930
Management income	.....	...	..	.....	...	.....	.....	32,653

* Original computations rounded to nearest dollar.

TABLE 19

OPTIMUM ENTERPRISE COMBINATION FOR A FARM WITH CROPS AND 3,600 FEEDERS WITH GREENCHOP ALTERNATIVES, IMPERIAL VALLEY

Item	Unit	Number of units	Variable cost per unit	Total variable cost	Total revenue per unit	Total revenue	Net revenue	Summary farm costs and returns
			*dollars**					
Fall greenchop	head	1,729	98	169,425	135	233,415	63,990	.....
Spring greenchop	head	2,972	98	291,226	135	401,220	109,994	.....
Crops								
Alfalfa	acres	289	41	11,947	...	.....	.....	.....
Sorghum silage (early 2 cuts)	acres	171	78	13,382	...	.....	.....	.....
Buy feed and bale								
Buy hay	tons	178	26	4,636	...	.....	.....	.....
Buy grain	tons	1,058	46	481,125	...	.....	.....	.....
Bale (3 cuttings)	acres	177	13	2,358	...	.....	.....	.....
Total revenue	.....	...	..	.....	...	634,635	.....	634,635
Total variable cost	.....	...	..	541,100	...	.....	.....	541,100
Total annual fixed cost	.....	...	..	.....	...	.....	.....	64,922
Depreciation	.....	...	..	.....	...	.....	.....	21,377
Interest on investment	.....	...	..	.....	...	.....	.....	22,514
Taxes and insurance	.....	...	..	.....	...	.....	.....	7,025
Interest on borrowed capital	.....	...	..	.....	...	.....	.....	2,007
Foreman and bookkeeping	.....	...	..	.....	...	.....	.....	12,000
Income over variable costs	.....	...	..	.....	...	.....	93,536	93,536
Net farm income	.....	...	..	.....	...	.....	.....	51,127
Management income	.....	...	..	.....	...	.....	.....	28,613

* Original computations rounded to nearest dollar.

The Effects of Cattle Prices, Margins, and Feed Efficiency on Net Returns for Feeders

The considerable variability in cattle prices, buying-selling margins, and feed efficiency of different lots of cattle is well recognized. Figure 3 illustrates the impact of these factors on net returns (gross income minus variable costs) per acre for both the pasture and greenchop feeding programs. Net returns per acre were used as the economic indicator because they provided a common denominator by which cash crops could be compared to using the land for cattle feeding purposes. However, while the comparison is indicative it is only partial, since fixed costs are not included.

The vertical line in figure 3 indicates the base price of calves and feeders ($22.50 per hundredweight) used in programming the optimum plans shown in tables 14 through 19. Since a zero price margin (i.e., equal "in" and "out" price) and 1.67 pounds of gain per day were assumed, the net return per acre for the respective cattle feeding system can be read directly as the intersection of the designated diagonal and vertical line. For example, figure 3 shows that the net return per acre for pastured feeders according to the optimum plan shown in table 15 is $204 (Point A, fig. 3). Calculation procedures are as follows:

$$= \frac{\$143,736.32 - 17,547.02 - 46,992.50}{388}$$

$$= \frac{\$79,196.80}{388} = 204.12$$

If we assume a price of $19 per hundredweight with gain and margin remaining the same, the comparable net return per acre is read directly as $140 (Point B, fig. 3). Net revenues per acre for other pasture and greenchop plans at various margins, and absolute price levels can be read directly from figure 3 in the same way. Net revenues per acre for selected cash crops are indicated as horizontal lines for comparisons to using the land for cattle feeding.

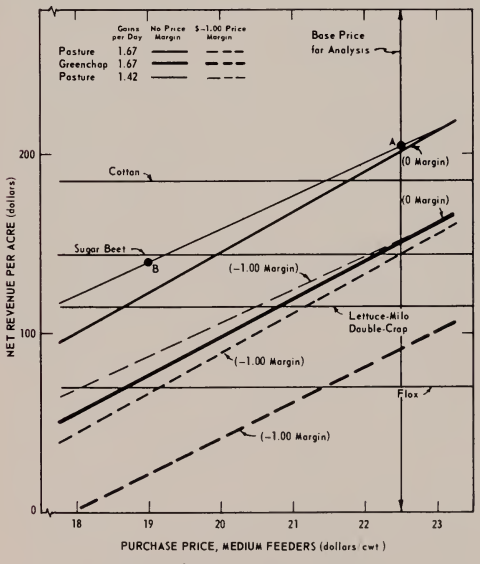


Fig. 3. Effects of heavy feeder prices, margins and feed efficiency on net returns, and a comparison with selected cash crops.

Note that at the base assumption both greenchop feeding and pasture feeding outcompete all cash crops including cotton. Prices of calves and feeders would have to drop to $21.75 per hundredweight on the greenchop program and to $21.50 on the pasture program before cotton brings an equivalent value per acre. On the other hand, only slight negative price margins on cattle could make cotton more profitable than the cattle feeding alternatives. At a $22.50 buying price for example, a negative $1.00 price margin on feeding would allow cotton to outcompete cattle in the optimum program. This comparison emphasizes again why most farmers would include cotton in the program, lowering risk and sacrificing little, if any, average net income.

Doubts might well be raised concerning our earlier assumption that gains per day are equivalent (1.67 pounds per day) for feeders on pasture and feeders in drylot on greenchop. For comparison, suppose gains on pasture were 15 per cent lower (1.42 pounds per day). Figure 3 shows that the net returns per acre for the pasture program would drop from $204 per acre to about $152 per acre. In terms of the plans presented earlier (tables 14 through 18), the net farm income from the pasture

plan would be reduced to about the same level as incomes from the greenchop plans and the cash crop plan.

It would appear that the major conclusion from this sensitivity analysis is perhaps to stress that relative income performance among the various cattle-feeding systems and cash-crop farming alone is extremely sensitive to the key assumptions made with regard to prices, price margins, and gains per day. Because of this, the plans presented should be interpreted as guides to be followed with due regard to the underlying assmuptions.

Optimum Plans and Returns for Crop-Finish Feedlot Operations

The purpose of this section is to determine the cropping system, type of rations fed, and the expected levels of income from a crop farm which adds a feedlot for finishing animals to slaughter weight. In these plans, finishing steers in drylot is the only type of livestock considered; lighter feeders on pasture or in drylot with greenchop are excluded. We present later the optimum plans and the income levels possible where all livestock alternatives are allowed to compete directly for farm resources. Plans are derived for finishing feedlots of 1,200-, 2,400- and 3,600-head capacity. The effects on income of alternative cattle prices, margins, and feed efficiency are also examined.

1,200-Head Capacity

Table 20 presents the optimum cropping system and numbers of cattle finished on each ration where drylot facilities are limited to 1,200 head per period. Cash crops in the plan include 72 acres of cotton (the allotment acreage), the maximum contract acreage of sugar beets (72 acres), and lettuce leased out (115 acres). The remaining acreage is used for crops to support the cattle feeding enterprise, including 129 acres of alfalfa, 187 acres of early-cut sorghum silage (of which 115 acres are double cropped with the lettuce), and 72 acres of late sorghum silage planted after sugar beets in the rotation. In other words, it is more economical to grow the high-income cash crops and buy feed than to include more alfalfa, sorghum, and grain in the cropping system. However, the interrelationship among the alfalfa, sorghum silage and rations fed is quite complex—the exact acreages and numbers of cattle fed on each ration depending primarily on the time sequence of crops on the limited land. Thus, while sorghum silage is the cheapest source of feed, any additional acreage of that crop would have disrupted the crop sequence and lowered net income from the over-all program. Given the amount of sorghum silage, the maximum number of cattle (1,528 head) are fed on the ration (#4, table 5) including sorghum silage; 1,200 head are fed in the spring and the remaining 328 head in the fall. The remaining 872 cattle required to fill the lot in the fall are fed on ration #2. While the data of table 7, presented earlier, would seem to indicate a higher net revenue per steer from ration #1 (based on nonfeed costs), the inclusion of feed costs, including raised alfalfa, tips the advantage to ration #2. In addition to raised alfalfa, the over-all program requires purchase of some hay (26.5 tons) and considerable grain (1,136.6 tons).

At the cattle prices assumed (buying feeders at $22.50 per hundredweight and selling finished animals for $23.00 per hundredweight), the addition of the 1,200-head feedlot to a cash crop operation actually depresses management income from $29,045 (table 14) to $16,466 (table 20). Also, the income from the 1,200-head finish feedlot is less than from either the pasture operations or greenchop operations discussed earlier. An additional disadvantage of the finish operation is that it is generally considered to involve greater risk than either the cash crop or feeder operations.

When the selling price is more favorable for finished animals, however, net farm income and management income increase sharply. With a selling price of $25.00 (a $2.50 margin), the 1,200-head capacity finishing operation is about equivalent to

TABLE 20

OPTIMUM ENTERPRISE COMBINATION FOR A FARM WITH CROPS AND 1,200 CATTLE ON FINISHING ALTERNATIVES, IMPERIAL VALLEY

Item	Unit	Number of units	Variable cost per unit	Total variable cost	Total revenue per unit	Total revenue. Price = $23 per cwt.	Summary farm costs and returns at various cattle prices		
							Price = $23 per cwt.	Price = $24 per cwt.	Price = $25 per cwt.
			*dollars**						
Fall finish									
Finish ration #2	head	872	161	139,973	217	189,128	.....	.....	.....
Finish ration #4	head	328	160	25,644	204	66,991	.....	.....	.....
Spring finish									
Finish ration #4	head	1,200	160	192,600	204	245,088	.....	.....	.....
Crops									
Sorghum silage (early 1 cut)	acres	187	61	11,370	...	.....	.....	.....	.....
Lettuce lease	acres	115	...	.....	65	7,475	.....	.....	.....
Cotton	acres	72	290	20,873	475	34,193	.....	.....	.....
Sugar beets	acres	72	181	13,032	323	23,255	.....	.....	.....
Alfalfa	acres	129	41	5,333	...	.....	.....	.....	.....
Sorghum silage (late 1 cut)	acres	72	55	3,991	...	.....	.....	.....	.....
Buy—sell—bale									
Sell winter pasture	acres	129	...	.....	20	2,561	.....	.....	.....
Bale alfalfa hay	acres	129	27	3,435	...	.....	.....	.....	.....
Buy alfalfa hay	tons	26	26	689	...	.....	.....	.....	.....
Buy grain	tons	1,137	46	51,715	...	.....	.....	.....	.....
Total revenue	.....	.....	...	.....	...	568,690	568,690	590,481	612,273
Total variable cost	.....	.....	...	495,655	...	.....	495,655	495,655	495,655
Total annual fixed cost	.....	.....	...	.....	...	.....	56,569	56,569	56,569
Depreciation	.....	.....	...	.....	...	.....	14,153	.....	.....
Interest on investment	.....	.....	...	.....	...	.....	21,091	.....	.....
Taxes and insurance	.....	.....	...	.....	...	.....	6,559	.....	.....
Interest on borrowed capital	.....	.....	...	.....	...	.....	2,766	.....	.....
Foreman and bookkeeping	.....	.....	...	.....	...	.....	12,000	.....	.....
Income over variable costs	.....	.....	...	.....	...	.....	73,035	94,826	116,618
Net farm income	.....	.....	...	.....	...	.....	37,556	59,348	81,140
Management income	.....	.....	...	.....	...	.....	16,466	38,257	60,049

* Original computations rounded to nearest dollar.

the incomes from the pasture feeder operation (table 15). A more detailed discussion of the effects of cattle prices on income is given at the conclusion of this section.

2,400-and 3,600-Head Capacity

Tables 21 and 22 show the optimum plans for finish feeding, assuming an increase in drylot capacity to 2,400 and 3,600 head, respectively. The cropping programs in both cases are identical to that obtained for the 1,200-head capacity. Sorghum silage ration #4 again is fed to 1,528 head (the maximum number of cattle that can be finished on the sorghum acreage) in spring. In both cases, the remaining cattle fed in spring and the full lot fed in fall are on ration #2. Obviously, much larger proportions of the feed requirements—alfalfa and grain—must be purchased as the feedlot expands.

At the base prices used, there is little incentive to expand finishing feedlot facilities beyond 1,200 head. Net farm income and management income levels are about the same for all three capacity levels; the additional income from feeding the increased number of cattle is offset by added annual fixed costs associated with the increased investment. The base prices used appear to approximate break-even prices for this type of operation.

However, as the selling price increases to $25.00, the added volume of cattle leads to sharp increases in income. At this price level, both the 2,400- and 3,600-head capacity finishing operations return far more than any of the other types of operations considered. If negative price margins occur, however, losses would also increase sharply with volume. The next sections investigate more systematically the effects of gains per day and price levels and margins on management income levels.

Effects of Daily Gains on Management Income

Figures 4 and 5 show the effects of both daily weight gain and "out" prices of finish cattle on management income corresponding to optimum plans for the 1,200-, 2,400- and 3,600-head capacity levels (tables 20, 21, and 22, respectively). The (+ or –) daily gain levels are considered as changes from the base assumptions of the analysis. Since only two rations were fed (#2 with 2.38 pounds per gain per day, and #4 with 2.00 pounds per gain per day) the changes relate to these levels. For example, a +0.25 pounds in figures 4 or 5 refers to a gain level of 2.63 (= 2.38 + 0.25) pounds for #2 ration and 2.25 (= 2.00 + 0.25) pounds for #4 ration. The diagonal lines correspond to management incomes for three selling prices ($24.00, $23.00, and $22.00 per hundredweight) with feeder prices held constant at the base price of $22.50 per hundredweight. The horizontal line in each figure shows the level of management income from cash crops alone.

Figure 4 (lower portion) shows that for a 1,200-head capacity feedlot with a $22 out price, ($–0.50 price margin), daily gain must exceed the base gains by 0.07 pounds to reach a break-even (zero) management income level (Point A); daily gains of more than 2.70 pounds per day for ration #2 and 2.30 pounds per day for ration #4 would be necessary to achieve a management income comparable to that attained for cash crops without livestock. Even at a $23.00 selling price ($0.50 price margin), daily gains of 0.08 pounds per day above the base assumptions are needed in order that management income from the cattle feeding program equals that from the cash crop plan (Point B). But with a $24.00 selling price management income for the cattle finishing program is well above that achieved with cash crops alone, even at base gain levels; at higher gain levels the advantage to the finishing operation becomes quite substantial. These same general relationships between daily gain and management income also are apparent for the 2,400- and 3,600-head capacity feedlots (top portion, figs. 4 and 5). However, the greater the number of cattle fed, the more significant the effect on the income level for a given fluctuation in gain (note increases in slope of income lines as capacity increases). For example, a 0.10 pound change from the base daily gain results in a $9,000 change in management income at the 1,200-head capacity level, a $17,000 change at the 2,400-head level, and a $24,000 change at the 3,600-head level. Perhaps

TABLE 21

OPTIMUM ENTERPRISE COMBINATION FOR A FARM WITH CROPS AND 2,400 CATTLE ON FINISHING ALTERNATIVES, IMPERIAL VALLEY

Item	Unit	Number of units	Variable cost per unit	Total variable cost	Total revenue per unit	Total revenue. Price = $23 per cwt.	Summary farm costs and returns at various cattle prices		
							Price = $23 per cwt.	Price = $24 per cwt.	Price = $25 per cwt.
			*dollars**						
Fall finish									
Finish ration #2	head	2,400	161	385,248	217	520,536	.....	.....	.....
Spring finish									
Finish ration #2	head	872	161	139,973	217	189,128	.....	.....	.....
Finish ration #4	head	1,528	160	245,244	204	312,079	.....	.....	.....
Crops									
Sorghum silage (early 1 cut)	acres	187	61	11,370	...	.....	.....	.....	.....
Sorghum silage (late 1 cut)	acres	72	55	3,991	...	.....	.....	.....	.....
Lettuce lease	acres	115	...	.....	65	7,475	.....	.....	.....
Cotton	acres	72	290	20,873	475	34,193	.....	.....	.....
Sugar beets	acres	72	181	13,032	323	23,255	.....	.....	.....
Alfalfa	acres	129	41	5,333	...	.....	.....	.....	.....
Buy—sell—bale									
Sell winter pasture	acres	129	...	.....	20	2,561	.....	.....	.....
Bale alfalfa hay	acres	129	27	3,435	...	.....	.....	.....	.....
Buy alfalfa hay	tons	2,230	26	57,972	...	.....	.....	.....	.....
Buy grain	tons	2,637	46	119.974	...	.....	.....	.....	.....
Total revenue	.....	.....	...	.....	...	1,089,226	1,089,226	1,133,650	1,178,073
Total variable cost	.....	.....	...	1,006,446	...	.....	1,006,446	1,006,446	1,006,446
Total annual fixed cost	.....	.....	...	.....	...	.....	64,857	64,857	64,857
Depreciation	.....	.....	...	.....	...	.....	17,893	.....	.....
Interest on investment	.....	.....	...	.....	...	.....	22,147	.....	.....
Taxes and insurance	.....	.....	...	.....	...	.....	6,911	.....	.....
Interest on borrowed capital	.....	.....	...	.....	...	.....	5,905	.....	.....
Foreman and bookkeeping	.....	.....	...	.....	...	.....	12,000	.....	.....
Income over variable costs	.....	.....	...	.....	...	.....	82,780	127,204	171,627
Net farm income	.....	.....	...	.....	...	.....	40,071	84,494	128,918
Management income	.....	.....	...	.....	...	.....	17,924	62,347	106,771

* Original computations rounded to nearest dollar.

TABLE 22

OPTIMUM ENTERPRISE COMBINATION FOR A FARM WITH CROPS AND 3,600 CATTLE ON FINISHING ALTERNATIVES, IMPERIAL VALLEY

Item	Unit	Number of units	Variable cost per unit	Total variable cost	Total revenue per unit	Total revenue. Price = $23 per cwt.	Summary farm costs and returns at various cattle prices		
							Price = $23 per cwt.	Price = $24 per cwt.	Price = $25 per cwt.
			*dollars**						
Fall finish									
Finish ration #2	head	3,600	161	577,872	217	780,804	.....	.....	.....
Spring finish									
Finish ration #2	head	2,072	161	332,597	217	449,396	.....	.....	.....
Finish ration #4	head	1,528	160	245,244	204	312,079	.....	.....	.....
Crops									
Sorghum silage (early 1 cut)	acres	187	61	11,370	...	.....	.....	.....	.....
Sorghum silage (late 1 cut)	acres	72	55	3,991	...	.....	.....	.....	.....
Lettuce lease	acres	115	...	.....	65	7,475	.....	.....	.....
Cotton	acres	72	290	20,873	475	34,193	.....	.....	.....
Sugar beets	acres	72	181	13,032	323	23,255	.....	.....	.....
Alfalfa	acres	129	41	5,333	...	.....	.....	.....	.....
Buy—sell—bale									
Sell winter pasture	acres	129	...	.....	20	2,561	.....	.....	.....
Bale alfalfa hay	acres	129	27	3,435	...	.....	.....	.....	.....
Buy alfalfa hay	tons	4,433	26	115,255	...	.....	.....	.....	.....
Buy grain	tons	4,138	46	188,265	...	.....	.....	.....	.....
Total revenue	.....	.....	...	.....	...	1,609,762	1,609,762	1,676,818	1,743,873
Total variable cost	.....	.....	...	1,517,268	...	.....	1,517,268	1,517,268	1,517,268
Total annual fixed cost	.....	.....	...	.....	...	.....	74,755	74,755	74,755
Depreciation	.....	.....	...	.....	...	.....	22,648	.....	.....
Interest on investment	.....	.....	...	.....	...	.....	23,654	.....	.....
Taxes and insurance	.....	.....	...	.....	...	.....	7,414	.....	.....
Interest on borrowed capital	.....	.....	...	.....	...	.....	9,039	.....	.....
Foreman and bookkeeping	.....	.....	...	.....	...	.....	12,000	.....	.....
Income over variable costs	.....	.....	...	.....	...	.....	92,494	159,550	226,605
Net farm income	.....	.....	...	.....	...	.....	41,394	108,449	175,505
Management income	.....	.....	...	.....	...	.....	17,739	84,795	151,850

* Original computations rounded to nearest dollar.

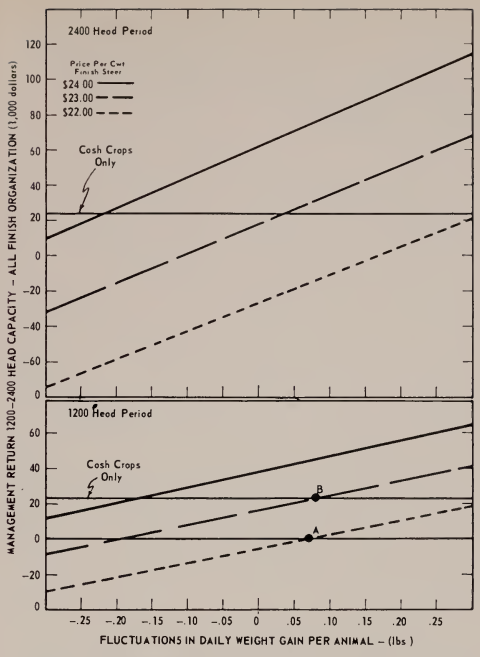


Fig. 4. Effects of daily weight gain and selling prices on management income for the all finish cattle programs (1,200- and 2,400-head capacity).

this is another way of saying that the variability in income may be greater for the cattle feeder as he increases his scale of operation; that is, he has chances for bigger gains and bigger losses.

One of the striking ideas derived from figures 4 and 5 is that buying and selling cattle on favorable terms may be much more important than high rates of daily gain in determining profits. For example, a dollar per hundredweight increase in selling price can offset 0.25 to 0.30 pounds lower gains per day. Buying prices would have a similar effect. Feeders recognize the importance of buying prices in the saying, "Profits or losses on a lot of cattle are determined on the day they are bought." Of course, given the buying and selling prices, maximum gains per day from a particular ration are desirable, but potential feeders should not labor under the illusion that they need only do a good job of feeding to make profits. A feedlot operator who obtains good gains from cattle in the lot, but who lacks skill in buying and selling, might well consider feeding cattle on contract as an alternative.

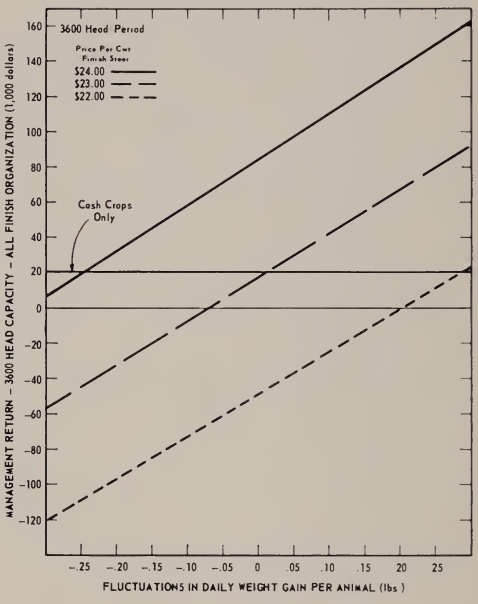


Fig. 5. Effects of daily weight gain and finish cattle prices on management for all finish cattle programs (3,600-head capacity).

Effects of Absolute Prices and Price Margins on Management Income for the 2,400-Head Finish Feedlot Plan

Figure 6 illustrates the sensitivity of the management income level to alternative assumptions regarding the purchase price and the price margin (difference between purchase and sale price) of finish cattle. The illustration pertains to the optimum plan for the 2,400-head capacity lot (table 21), although results would be similar for the 1,200- and 3,600-head lots. Daily weight gain per day is assumed constant at the base level (table 5). The base prices for the analysis were a purchase price of $22.50 per hundredweight (indicated by the center vertical line) and a sale price of $23.00 —a +$0.50 margin; the corresponding management income for this plan was about $18,000 (Point A). With a price margin of $1.50 (an increase of $1.00) or a selling price of $24.00, the management income is about $62,000 (Point B)—an increase of $42,000. In contrast, a price margin of –$0.50 (a decline of $1.00 from that assumed in the analysis, or a selling price of $22.00) leads to a management income of –$27,000. However, the higher the absolute price level, the less vulnerable is the cattle feeder to a low margin. For an example, based on the plan in table 21, a purchase price of $25,00 and a –$0.50 margin would still result in positive management income. At this higher level of prices, the profit made from the gain is more than enough to compensate for the loss on the purchase weight. The sizable variations in income levels that arise from small changes in the basic assumptions emphasize that caution should be taken in viewing the income levels associated with the different plans analyzed in this report.

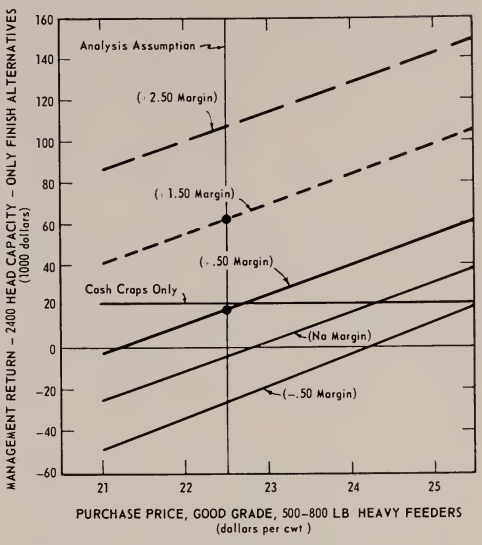


Fig. 6. Management income as a function of price movements-purchase-sale margins and absolute levels, all finish alternatives (2,400-head capacity).

Optimum Plans and Returns for Crops-Choice of All Cattle Alternatives

This section presents the optimum combination of crops and livestock when the operator has a feedlot (1,200-, 2,400-, or 3,600-head capacity) and a choice among all the feeder animal alternatives (pasture or greenchop) and finishing alternatives. Some of the relevant questions to be answered here are: Is the feedlot more profitably used for feeder or finishing animals? To what extent does the feeder program tie in with the finishing program? Should land be used for cash crops while steers are purchased for feedlot finishing? Or should the land be used for roughage, feeders raised on the farm and then transferred to the feedlot?

Tables 23, 24, and 25 summarize the optimum plans and incomes obtained for operations with a feedlot capacity of 1,200, 2,400, and 3,600 head. Examination of the results indicates a striking similarity among the plans. The cropping system is exactly the same in each case. For reasons of stability argued earlier, 72 acres of land are reserved for cotton production. If cotton were not forced into the plan, changes

TABLE 23

OPTIMUM ENTERPRISE COMBINATION FOR A FARM WITH CROPS AND 1,200 CATTLE WITH ALL FEEDING ALTERNATIVES ALLOWED, IMPERIAL VALLEY

Item	Unit	Number of units	Variable cost per unit	Total variable cost	Total revenue per unit	Total revenue. Price = $23 per cwt.	Summary farm costs and returns at various cattle prices		
							Price = $23 per cwt.	Price = $24 per cwt.	Price = $25 per cwt.
			*dollars**						
Fall feeding									
Ration #2	head	1,200	16	19,668	217	260,268	.....	.....	.....
Alfalfa pasture #1	head	1,002	92	91,994	...	.....	.....	.....	.....
Alfalfa-oat pasture #2	head	308	92	28,277	...	.....	.....	.....	.....
Spring feeding									
Ration #2	head	1,200	16	19,668	217	260,268	.....	.....	.....
Alfalfa pasture #1	head	1,722	92	158,097	...	.....	.....	.....	.....
Alfalfa Sudan pasture #3	head	296	92	27,176	...	.....	.....	.....	.....
Crops									
Sudan pasture	acres	35	45	1,575	...	.....	.....	.....	.....
Oat pasture	acres	35	39	1,379	...	.....	.....	.....	.....
Cotton	acres	72	290	20,873	475	34,193	.....	.....	.....
Alfalfa	acres	353	41	14,593	...	.....	.....	.....	.....
Buy—sell									
Buy alfalfa hay	tons	2,393	26	62,223	...	.....	.....	.....	.....
Buy grain	tons	2,374	46	108,026	...	.....	.....	.....	.....
Sell heavy feeders	head	928	...	.....	135	125,280	.....	.....	.....
Bale alfalfa hay	acres	175	13	2,331	...	.....	.....	.....	.....
Total revenue	.....	.....	...	.....	...	680,009	680,009	702,641	725,273
Total variable cost	.....	.....	...	555,880	...	.....	555,880	555,880	555,880
Total annual fixed cost	.....	.....	...	.....	...	.....	60,917	60,917	60,917
Depreciation	.....	.....	...	.....	...	.....	15,557	.....	.....
Interest on investment	.....	.....	...	.....	...	.....	21,424	.....	.....
Taxes and insurance	.....	.....	...	.....	...	.....	6,661	.....	.....
Interest on borrowed capital	.....	.....	...	.....	...	.....	5,275	.....	.....
Foreman and bookkeeping	.....	.....	...	.....	...	.....	12,000	.....	.....
Income over variable costs	.....	.....	...	.....	...	.....	124,129	146,761	169,393
Net farm income	.....	.....	...	.....	...	.....	84,636	107,268	129,900
Management income	.....	.....	...	.....	...	.....	63,212	85,844	108,476

* Original computations rounded to nearest dollar.

TABLE 24

OPTIMUM ENTERPRISE COMBINATION FOR A FARM WITH CROPS AND 2,400 CATTLE WITH ALL FEEDING ALTERNATIVES ALLOWED, IMPERIAL VALLEY

Item	Unit	Number of units	Variable cost per unit	Total variable cost	Total revenue per unit	Total revenue. Price = $23 per cwt.	Summary farm costs and returns at various cattle prices		
							Price = $23 per cwt.	Price = $24 per cwt.	Price = $25 per cwt.
			dollars*						
Fall feeding									
Ration #2	head	2,400	16	39,336	217	520,536	.....	.....	.....
Alfalfa pasture #1	head	1,002	92	91,994	...	.....	.....	.....	.....
Alfalfa-oat pasture #2	head	308	92	28,277	...	.....	.....	.....	.....
Spring feeding									
Ration #2	head	2,400	16	39,336	217	520,536	.....	.....	.....
Alfalfa pasture #1	head	1,722	92	158,097	...	.....	.....	.....	.....
Alfalfa-Sudan pasture #3	head	296	92	27,176	...	.....	.....	.....	.....
Crops									
Sudan pasture	acres	35	45	1,575	...	.....	.....	.....	.....
Oat pasture	acres	35	39	1,379	...	.....	.....	.....	.....
Cotton	acres	72	290	20,873	475	34,193	.....	.....	.....
Alfalfa	acres	353	41	14,593	...	.....	.....	.....	.....
Buy—sell									
Buy alfalfa hay	tons	4,596	26	119,506	...	.....	.....	.....	.....
Buy heavy feeders	head	1,472	141	206,993	...	.....	.....	.....	.....
Buy grain	tons	3,875	46	176,331	...	.....	.....	.....	.....
Bale alfalfa hay	acres	175	13	2,331	...	.....	.....	.....	.....
Total revenue	.....	.....	...	.....	...	1,075,265	1,075,265	1,120,529	1,165,793
Total variable cost	.....	.....	...	927,796	...	.....	927,796	927,796	927,796
Total annual fixed cost	.....	.....	...	.....	...	.....	74,552	74,552	74,552
Depreciation	.....	.....	...	.....	...	.....	19,387	.....	.....
Interest on investment	.....	.....	...	.....	...	.....	22,541	.....	.....
Taxes and insurance	.....	.....	...	.....	...	.....	7,034	.....	.....
Interest on borrowed capital	.....	.....	...	.....	...	.....	13,590	.....	.....
Foreman and bookkeeping	.....	.....	...	.....	...	.....	12,000	.....	.....
Income over variable costs	.....	.....	...	.....	...	.....	147,469	192,733	237,997
Net farm income	.....	.....	...	.....	...	.....	95,458	140,722	185,986
Management income	.....	.....	...	.....	...	.....	72,917	118,181	163,445

* Original computations rounded to nearest dollar.

TABLE 25

OPTIMUM ENTERPRISE COMBINATION FOR A FARM WITH CROPS AND 3,600 CATTLE WITH ALL FEEDING ALTERNATIVES ALLOWED, IMPERIAL VALLEY

Item	Unit	Number of units	Variable cost per unit	Total variable cost	Total revenue per unit	Total revenue. Price = $23 per cwt.	Summary farm costs and returns at various cattle prices		
							Price = $23 per cwt.	Price = $24 per cwt.	Price = $25 per cwt.
			*dollars**						
Fall feeding									
Finish ration #2	head	3,600	16	59,004	217	780,804	.....	.....	.....
Alfalfa pasture #1	head	1,002	92	91,994	...	.....	.....	.....	.....
Alfalfa-oat pasture #2	head	308	92	28,278	...	.....	.....	.....	.....
Spring feeding									
Finish ration #2	head	3,600	16	59,004	217	780,804	.....	.....	.....
Alfalfa pasture #1	head	1,722	92	158,097	...	.....	.....	.....	.....
Alfalfa-Sudan pasture #3	head	1,296	92	27,176	...	.....	.....	.....	.....
Crops									
Sudan pasture	acres	35	45	1,575	...	.....	.....	.....	.....
Oat pasture	acres	35	39	1,379	...	.....	.....	.....	.....
Cotton	acres	72	290	20,873	475	34,193	.....	.....	.....
Alfalfa	acres	353	41	14,593	...	.....	.....	.....	.....
Buy—sell									
Buy heavy feeders	head	3,872	141	544,481	...	.....	.....	.....	.....
Buy alfalfa hay	tons	6,800	26	176,790	...	.....	.....	.....	.....
Buy grain	tons	5,377	46	244,635	...	.....	.....	.....	.....
Bale alfalfa hay	acres	175	13	2,331	...	.....	.....	.....	.....
Total revenue	.....	.....	...	.....	...	1,595,801	1,595,801	1,663,707	1,731,593
Total variable cost	.....	.....	...	1,430,208	...	.....	1,430,208	1,430,208	1,430,208
Total annual fixed cost	.....	.....	...	.....	...	.....	93,137	93,137	93,137
Depreciation	.....	.....	...	.....	...	.....	24,357	.....	.....
Interest on investment	.....	.....	...	.....	...	.....	24,070	.....	.....
Taxes and insurance	.....	.....	...	.....	...	.....	7,543	.....	.....
Interest on borrowed capital	.....	.....	...	.....	...	.....	25,166	.....	.....
Foreman and bookkeeping	.....	.....	...	.....	...	.....	12,000	.....	.....
Income over variable costs	.....	.....	...	.....	...	.....	165,593	233,489	301,385
Net farm income	.....	.....	...	.....	...	.....	96,526	164,422	232,318
Management income	.....	.....	...	.....	...	.....	92,456	140,352	208,248

* Original computations rounded to nearest dollar.

in the plan identical to those observed between tables 15 and 16 would occur. The livestock program consists both of feeders and slaughter animals. The number of feeders and the rations fed are identical regardless of the size of feedlot, suggesting that the livestock pasture program and use of land for pasture are determined independently of the size of feedlot and the opportunity of finishing the animals out on the same farm. The feedlot finishing operation uses the lot to capacity in every period and always uses the most profitable ration #2. It is more economical to transfer heavy feeders directly to the farm feedlot than to sell heavy feeders off pasture and then buy back feeders for the finishing lot. Thus, at the end of the pasture period the maximum number of feeders are taken off pasture and put in the lot: If the number of feeders exceeds feedlot capacity in the next period, the excess feeders are sold (table 23); if feedlot capacity exceeds farm raised feeders available from the preceding period, some additional feeders are purchased (table 25). All feeds for the finishing program are purchased, again emphasizing that the feeder and finishing programs are essentially additive rather than highly interdependent. As mentioned above, the major economy achieved by an integrated operation is achieved in the saving involved in transferring feeder animals to the finishing lot on the same farm, saving transportation costs, shrink and associated buying and selling costs.

The income levels for these coordinated pasture feedlot plans are the highest of any plans considered (tables 23, 24, and 25). At the base prices there is some advantage in expanding the feedlot capacity from 1,200 to 2,400 head but none in expanding to 3,600 head. Again, this emphasizes that base prices are close to "breakeven" prices. However, as the selling price and margin increase, the profit level increases considerably with the added volume. While these incomes appear highly favorable, it should be recalled that extreme fluctuation in income can be realized from price shifts and alternative feed efficiency levels.

Finally, it would appear that the complexities of managing a feeding operation of this type involving both a pasture and drylot program require supervisory and management capabilities well beyond the average. None of the farms surveyed in Imperial Valley were carrying on a feeding program identical to that discussed here. However, the coordinated program does appear to offer, on the basis of the analysis, a profitable possibility for more intensive use of limited acreage.

SUMMARY AND CONCLUSIONS

The major purpose of this report is to investigate the economic feasibility of intensifying small-scale Imperial Valley, California, crop farms through the addition of various types of cattle feeding enterprises. The results should also be applicable to small-scale cash crop farms in desert agricultural areas contiguous to the Imperial Valley.

To provide a realistic basis for the analysis, much of the data was obtained through direct interviews with nearly 60 farm operators in the Imperial Valley. Resources for a 480-acre farm were selected as typical for a small-scale crop operation. Evaluation of the various crop and livestock alternatives was made through the use of budgeting and linear programming. The study compares a basic cash crop operation with operations where two types of cattle feeding are added: (1) calves are purchased and raised to heavy feeder weight either on pasture or through greenchop feeding in drylot, and (2) feeders are finished to slaughter weight and grade in a feedlot. Greenchop feeding and cattle finishing are analyzed at three alternative levels of feedlot capacity: 1,200 head, 2,400 head, and 3,600 head. Alternative rations, sources of feed, investment requirements, and the interrelationship between crops and cattle feeding are integrated in the analysis. A supplementary analysis shows how income varies in the most profitable plans with changes in cattle prices, margins, and feeding efficiency.

Some of the main findings of this study can be summarized as follows:

(1) Although the 480-acre farm is smaller than average in the Imperial Valley, it provides a relatively favorable income level (a management income equal to approximately $29,000) when operated as a cash crop farm. Although the yields, prices, and costs assume somewhat above average management, they are nonetheless consistent with many actual operations. Thus, the owner of a well-managed cash crop operation may not feel any particular pressure to add livestock enterprises to obtain satisfactory income levels.

(2) Given the initial prices used in the analysis (feeder cattle $22.50 per hundredweight), growing calves to feeder weight on pasture provides a substantial increase in management income of about $20,000 over the cash crop plan. While the cotton allotment acreage is planted, the remainder of the farm is devoted to alfalfa, oat, and Sudan grass pastures.

(3) At the initial prices used in the analysis none of the greenchop plans offer a significant increase in income over the cash crop operation. Although the greenchop plan reduces waste of forage compared with the pasture plan, these savings are outweighed by the added investment and associated fixed costs for the feedlot and equipment required for greenchop feeding.

(4) The desirability of adding a cattle finishing operation depends primarily on relative feeder and slaughter cattle prices. At the base prices assumed (feeder cattle at $22.50 per hundredweight and finished cattle at $23.00 per hundredweight), none of the feedlot operations (1,200, 2,400, or 3,600 head) provides incomes as high as for the cash crop operation. However, slight increases in the slaughter prices (say to $25.00) sharply increase profits above any of the other plans; furthermore, the larger feedlots are proportionately more profitable. At depressed slaughter-cattle prices the reverse is true—larger lots lose more money.

(5) A coordinated plan consisting of feeders on pasture followed by finishing animals in the feedlot showed the highest income levels (at base prices) of any plans considered. The results indicated that the interdependency of the two feeding systems was not a dominant feature of the plan. The complexities of managing a feeding operation of this type would appear to require supervisory and management capabilities well beyond the average.

(6) Several factors should be seriously weighed by a cash crop operator before using any of the livestock plans outlined. A decision to include cattle represents a change to a substantially different business from a cash crop operation, and involves different types of problems and decisions. In all cases except that of the pasture program, capital investment increases by from $73,000 to $211,000 depending on the particular program selected. Price risk also increases sharply, particularly for the plans involving a cattle finishing operation. This especially emphasizes the necessity of development of special skills and business contacts relating to buying and selling cattle, considering both price and quality. Top management and feeding of the cattle once in the lot is a necessary but not a sufficient condition for high profits. Despite the best of management practices, the operator should be in a financial position to withstand inevitable losses in years of unfavorable prices.

(7) One limitation of the study is that the aggregate effects of an increase in cattle feeding are not considered. Conceivably, widespread adoption of the livestock plans presented in this report could exert measurable downward pressure on local cattle prices and some upward pressure on feed and other factors of production. However, it is anticipated that the importance of such aggregate effects will be slight relative to other variables.

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APPENDIX TABLES

Appendix Table A-1

PASTURE YIELDS BY MONTHS, IN POUNDS OF TOTAL DIGESTIBLE NUTRIENTS (TDN)*

Pasture feed	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	April	May	June	July	Aug.
Alfalfa	390	350	330	365	365	850	900	1,100	1,240	1,413	895	452
Barley	...	1,250	1,250	...	...	...	...	...	...	...	...	...
Oats	...	...	...	1,667	1,667	1,667	...	...	...	...	...	...
Sudan grass	...	...	...	...	...	...	...	...	...	1,600	1,600	1,600
Beet tops	...	...	...	...	...	...	...	1,250	1,250	...	...	...

* Based on unpublished data in experiments conducted by Dr. E. Stanford, Mr. D. Sumner, and Dr. R. Loomis, Agronomy Department, University of California, Davis, California.

Appendix Table A-2

IMPERIAL VALLEY FEEDS AND CORRESPONDING NUTRIENT COMPOSITION, WITH FEED REQUIREMENTS OF STEERS*

Feed	Dry matter	Total digestible nutrients	Digestible protein	Calcium	Phosphorus	Energy	Carotene
	per cent composition					*therms per cwt.*	*mgs per lb.*
Concentrates							
Barley	89.9	78.8	6.9	0.06	0.33	71.4	0.2
Cottonseed meal	92.6	72.3	33.7	0.19	0.97	76.5	0.1
Milo	89.0	79.4	8.5	0.03	0.28	77.8	0.1
Molasses (beet)	80.5	60.8	4.4	0.05	0.02	43.3	....
Dry roughages							
Alfalfa hay	90.5	50.7	10.9	1.47	0.24	40.6	8.2
Barley straw	90.0	42.2	0.7	0.33	0.10	22.4	....
Flax straw	92.8	38.1	5.8	0.67	0.10	....	....
Silage							
Sorghum silage	25.4	15.2	0.8	0.08	0.05	12.2	2.7
Green roughages							
Alfalfa	24.4	14.8	3.5	0.40	0.06	12.9	28.3
Barley pasture	20.0	12.5	3.9	0.12	0.08	11.0	20.9
Beet tops	17.8	10.4	1.7	0.18	0.04	8.5	....
Oat pasture	14.1	9.2	2.4	0.06	0.09	8.0	27.0
Sudan grass	21.6	14.3	2.4	0.12	0.10	12.2	21.5
	pounds per day					*therms per day*	*mgs per day*
Requirements							
500-lb. steer	10.7–13.0	7.2–8.4	0.81–0.92	.042	.033	6.3–7.4	30
Requirements							
800-lb. steer	17.8–20.4	14.1–15.9	1.52–1.68	.044	.042	13.0–14.6	45

* Data from Morrison (1957).

Appendix Table A-3

PRICES OF MEDIUM GRADE 300–500 POUND FEEDER STEERS, LOS ANGELES AND PHOENIX MARKETS, 1956–1963

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual ave.
	dollars per cwt.												
Phoenix*													
1956	.....	.....	.....	.....	.....	.....	.....	15.50	15.00	14.65	14.13	14.16	....
1957	15.05	16.94	18.23	18.50	17.70	17.15	18.13	20.00	19.97	19.09	19.07	20.07	18.33
1958	21.44	23.03	25.15	24.74	24 50	24.50	25.34	25.75	25.95	26.60	27.10	27.25	25.11
1959	27.86	28.61	29.25	29.25	29.18	28.91	28.82	28.00	26.91	24.85	25.00	25.22	27.66
1960	26.00	25.98	25.50	25.50	25.50	23.58	22.34	21.57	21.25	20.69	21.05	22.31	23 44
1961	22.62	22.91	23.20	23.44	21.24	20 95	21.62	22.27	21.56	21.69	22.16	22.38	22.17
Monthly average	22.59	23.49	24.27	24.29	23.62	23.02	23.25	22.23	21.82	21.30	21.46	21.94	22.77
Los Angeles													
1956	..	.....	.....	.....	....	.....	.....	.....	.....	.....	15.44	15.50	.....
1957	15.70	16.06	17.56	18.00	17.95	17.25	18.12	N.A.†	N.A.†	19.00	19.69	21.11	18.09
1958	21.95	22.50	24.06	24.25	24.88	25.31	25.35	25.62	26.00	N.A.†	27.12	26.56	24.76
1959	26.75	N.A.†	N.A.†	28.00	29.25	28.00	28.22	28.17	28.40	26.28	23.83	23.08	27.00
1960	23.00	23.31	24.88	25.50	23.33	21.24	21.11	20.15	19.75	19.53	20.05	21.56	21.95
1961	22.38	23.62	22.68	22.88	21.44	21.45	20.91	22.07	22.14	21.75	22.50	23.88	22.31
1962	23.86	24.31	24.69	25.19	24.90	23.19	22.25	23.17	23.70	24.10	24.36	24.16	23.99
1963	23.40	22.75	22.56	21.47	22.58	23.13	23.00	22.13	21.75	N.A.†	N.A.†	N.A.†	22.53
Monthly average	22.43	22.09	22.74	23.61	23.48	22.80	22.71	23.55	23.62	22.13	21.86	22.26	22.95

* 1962–3 prices for the Phoenix market are not available in compilable form.
† Prices not available were estimated by an average of the preceding and following monthly prices for margin calculations.
Source: Federal-State Market News Service (1951–63).

Appendix Table A-4

PRICES OF GOOD GRADE 500–800 POUND FEEDER STEERS, LOS ANGELES AND PHOENIX MARKETS, 1956–63

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual ave.
	dollars per cwt.												
Phoenix*													
1956	.....	.....	.....	.....	.....	.....	.....	16.73	16.88	16.42	16.13	15.85	.....
1957	16.35	17.47	18.46	18.87	19.01	18.92	19.66	20.40	20.27	19.30	20.30	20.65	19.14
1958	22.32	23.97	25.50	25.22	24.87	24.80	24.90	23.83	23.75	24.24	23.53	24.23	24.26
1959	25.65	25.20	27.35	27.73	27.69	27.38	26.95	26.25	24.29	23.42	23.75	24.06	25.81
1960	24.46	24.50	24.50	24.38	24.00	23.35	23.49	22.40	21.13	21.40	21.98	22.75	23.20
1961	23.12	22.78	23.26	23.25	21.31	21.38	21.82	22.84	22.12	21.63	21.87	22.75	22.34
Monthly average	22.38	22.78	23.81	23.89	23.38	23.17	23.36	22.12	21.45	21.11	21.30	21.76	22.54
Los Angeles													
1956	16.64	16.35	16.69	17.44	17.50	17.50	17.50	17.70	18.00	17.34	16.68	16.94	17.19
1957	16.87	17.51	19.02	20.06	20.54	19.88	19.98	19.81	19.31	19.51	21.31	22.04	19.65
1958	23.33	24.12	25.83	25.92	23.35	25.38	25.03	N.A.†	24.12	25.25	25.44	25.68	25.04
1959	26.84	26.36	26.25	27.48	27.88	26.92	26.96	27.12	27.18	25.25	24.12	24.35	26.39
1960	24.50	24.81	25.84	26.69	25.83	23.64	23.03	22.26	21.50	20.97	21.62	23.38	23.67
1961	23.75	24.02	23.53	23.47	22.46	22.10	22.00	23.39	23.84	23.09	23.15	23.81	23.22
1962	23.99	24.09	24.88	24.69	24.22	23.88	23.85	24.17	24.39	24.76	25.14	25.00	24.45
1963	24.96	23.44	22.78	24.12	23.04	20.88	22.74	23.06	22.78	21.10	20.86	20 88	22.55
Monthly average	22.61	22.59	23.10	23.73	23.10	22.52	22.64	22.50	22.68	22.16	22.29	22.76	22.74

* 1962–3 prices for the Phoenix market are not available in compilable form.
† Prices not available were estimated by an average of the preceding and following monthly prices for use in margin calculations.
Source: Federal-State Market News Service (1951–63).

Appendix Table A-5

PRICES FOR GOOD AND CHOICE GRADE 900–1,100 POUND SLAUGHTER CATTLE, EL CENTRO MARKET, 1956–1963

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual ave.
	dollars per cwt.												
Good													
1956	.....	.....	.....	.....	.....	.....	.....	.....	21.88	21.01	19.69	19.51	.....
1957	18.84	18.84	21.01	22.00	22.28	22.16	23.35	23.49	22.00	20.99	21.89	23.71	21.71
1958	24.75	25.16	26.81	27.14	26.89	27.20	26.09	24.30	24.80	24.61	24.63	25.77	25.68
1959	27.00	26.01	26.39	27.26	27.88	27.17	26.55	25.80	24.96	24.42	23.20	23.97	25.88
1960	24.85	24.82	25.42	25.81	25.90	24.79	24.63	23.72	22.88	22.00	22.01	23.54	24.20
1961	24.01	23.68	23.66	22.94	21.92	21.98	22.62	23.37	23.36	22.75	22.71	23.98	23.00
1962	24.92	25.14	25.43	25.39	25.51	24.72	24.62	25.07	25.73	25.17	25.62	25.78	25.26
1963	25.77	24.69	22.36	22.60	21.39	21.95	24.26	23.94	23.50	22.29	20.98	20.65	22.92
Monthly average	24.31	24.05	24.44	24.73	24.54	24.28	24.59	24.24	23.64	22.90	22.59	23.36	24.09
Choice													
1956	.....	.....	.....	.....	.....	.....	.....	.....	24.12	23.14	21.52	21.38	.....
1957	20.55	20.12	22.44	23.48	23.51	23.49	24.76	24.96	23.58	22.31	22.96	25.00	23.09
1958	26.34	26.68	28.78	29.25	28.25	29.18	28.25	26.38	26.59	26.51	25.75	27.15	27.43
1959	28.66	27.68	27.96	28.75	29.48	29.00	28.25	27.40	27.09	25.84	24.92	25.85	27.58
1960	26.52	26.33	26.87	27.38	27.30	26.49	25.94	24.93	24.22	23.08	23.21	24.95	25.60
1961	25.62	24.94	24.78	24.06	22.94	23.10	23.54	24.58	24.38	23.90	23.69	25.08	24.22
1962	26.31	26.38	26.72	26.66	26.81	26.01	25.67	26.32	27.10	26.56	26.92	27.25	26.56
1963	27.25	25.66	23.59	23.81	22.44	23.01	25.47	24.87	24.40	23.17	21.85	21.63	23.93
Monthly average	25.89	25.40	25.88	26.20	25.82	25.75	25.98	25.63	25.18	24.31	23.85	24.79	25.49

Source: Federal-State Market News Service (1951–63).

Appendix Table A–6

FARM FEED MILL, CAPACITY 5 TONS PER HOUR

Item	Unit	Number of units	Specifications	Investment cost
				dollars
Bins	Bin	4	9C5 with ladders	2,755.00
Auger	Feet	19	6′ with variable speed	300.00
Spouting	Feet	100	6″–12 gauge	915.00
Screw	Feet	24	14″–complete with box and cover	
Discharge openings	....	2	welded on–7½ HP motor	670.00
Screw	...	20	9″–1 HP motor, cyclone frame, misc. brackets, hoppers, and dead box	
Hay mill	....	1	complete with dray; couplings, and magnets	3,803.00
Motor	....	1	100 HP–1,800 R.P.M.'s	1,379.00
Wiring	....	..		2,500.00
Concrete slab	....	1		2,500.00
Elevator leg	....	..	52 feet, one 3-way valve,	
	....	1	two 2-way valves	
Cast elbows	....	2		1,348.00
Working platform	....	1		
Motor	....	1		
Ladder	Feet	20		6,500.00
Grain roller and blower	....	1		1,540.00
Molasses tank and pump	....	1		3,500.00
Boiler	....	1		2,500.00
Shed	....	1		6,000.00
Tempering bin	....	1	20-ton—screw, scalper—18″ rod, 20 HP motor	500.00
Drop hopper	....	1	8′ × 5′ × 5′—10 gauge	
Total investment cost				36,710.00

6m-5,'65 (F1428s) VL